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Middle and Upper Smith River
Watershed Analysis
31 October 1995

I. INTRODUCTION

Watershed analysis is being undertaken on the Middle and Upper Smith River Watershed Analysis Units *[hereafter referred to as Smith River WAU]* as prescribed in the Standards and Guidelines for Management of Habitat for Late-Successional and Old-Growth Forest Related Species within the Range of the Northern Spotted Owl (S&Gs)(USDA and USDI 1994).

Watershed analysis is the gathering of information on and the description of the physical and biological processes that are active within and between watersheds. Analysis units range between 20 and 200 square miles. The results of this watershed analysis will be utilized to make informed management decisions and to identify specific projects that are compatible with the goals and objectives identified in the S&Gs for the benefit of the natural resources and the people dependent upon them. An interdisciplinary (ID) team (Appendix 1) has been established to conduct the analysis of the Smith River WAU.

The S&Gs identified three Land Use Allocations (LUAs) within the WAU (Table 1, Fig. 1).

Table 1. Land use allocations within the Smith River WAU.

Land Use Allocation	Size (ac.)	Percent (%)
General Forest Management Area	9484	31
Connectivity Block	1224	4
Late Successional Reserve	19886	65
Total	30594	100

General forest management areas (GFMAs) will be managed using intensive forest management practices to maintain long term site productivity, biological legacies, and a biologically diverse matrix. Connectivity lands will be managed to provide for movement, dispersal, connectivity of plant and animal species; limited commercial productivity; and to maintain ecotypic richness and diversity in the matrix. Mapped and unmapped Late Successional Reserves (LSRs) have been established to protect and enhance conditions of late-successional and old-growth forest ecosystems, which serve as habitat for late-successional and old-growth forest related species including the northern spotted owl (Strix occidentalis caurina) and the marbled murrelet (Brachyramphus marmoratus).

Overlaying connectivity and GFMA is a network of riparian reserves. Riparian reserves are one of the four components of the Aquatic Conservation Strategy put forth in the S&Gs (USDI and USDA 1994). The other three components are Key Watersheds, Watershed Analysis, and Watershed Restoration.

Management within the riparian reserves will be aimed at promoting the development of late-successional and old-growth forests. Riparian reserves are designed to "maintain and restore riparian structures and functions of intermittent streams, confer benefits to riparian-dependent and associated species other than fish, enhance habitat conservation for organisms that are dependent on the transition zone between upslope and riparian areas, improve travel and dispersal corridors for many terrestrial animals and plants, and provide for connectivity of the watershed." (USDA and USDI 1994:B-13).

The Smith River WAU is unique in the Tyee Resource Area in that it has been designated as a Tier 1 Key Watershed. Key watersheds "...are designated areas that either provide, or are expected to provide, high quality habitat. A system of Key Watersheds that serve as refugia is crucial for maintaining and recovering habitat for at-risk stocks of anadromous salmonids and resident fish species(USDA and USDI 1994:B-18)." Tier 1 key watersheds contribute directly to the conservation of at-risk fish species, have a high potential of being restored, and consist primarily of watersheds identified in previous scientific analyses (Johnson et al. 1991, SAT 1993, USDA et al. 1993). Key watersheds overlay other land use allocations (LUAs) and their standard and guidelines are applied in addition to those of the base LUA.

Location of Smith River WAU

The Smith River WAU lies in the northern portion of the Roseburg District, northwest of the town of Drain and northeast of Elkton (Fig. 2). Not entirely within the Roseburg District, portions occur in both the Eugene and Coos Bay Districts of the BLM.

The analysis area includes the entire Upper Smith River analytical watershed encompassing both the Middle and Upper Smith River watershed analysis units, approximately 49,346 acres of land (Table 2). The BLM administers 30,594 acres, approximately 62 percent, of the analysis area. Major private landowners include Weyerhaeuser and A.U. Jones Timber Company. Combined, the analysis area includes 20 smaller, sub-basins (Fig. 3).

Table 2. Size of the Smith River Watershed Analysis Unit.

Landscape Analysis Unit	Size (acres)	Percent (%)
Middle Smith	27446	56
Upper Smith	21900	44
Total	49346	100

II. DESCRIPTIONS OF WATERSHED FUNCTIONS

In preparing this report the ID team identified a list of 14 processes/ecological functions that could be considered key to the functioning of the watershed. Further discussion combined these processes into four main topics to be discussed, aquatic/hydrologic functioning, disturbance, climate, and geomorphology.

Aquatic/Hydrologic Functions

The Upper and Middle Smith River Watershed Analysis Unit (WAU) contains approximately 600 miles of streams within the 77.1 square mile (49,346 acre) basin. There are 20 subbasins within the WAU (Table 3).

Equivalent Clearcut Area

Equivalent Clearcut Percentages (ECA) were obtained using GIS to generate mapping units and associated areas (acres) for timber stands less than or equal to 5 years of age, and again for timber stands less than or equal to 20 years of age, on both federal and private land in the WAU subbasins (Table 4). ECA percentages are generally computed using timber stand ages less than or equal to 20 years of age Jones and Grant (1993). Only stands less than or equal to 5 years of age were used in this analysis because of the strong correlation of cause and effect described by the noted research efforts. This correlation becomes weaker over time, and is influenced by basin-specific parameters such as soil type, local climatological conditions, vegetative growing conditions, harvest techniques and intensity, and soil type. In this analysis, ECA percentages are being utilized to illustrate, identify, and rank the subbasins within the WAU that contain the highest proportions of acres considered to be hydrologically unrecovered.

Table 3. Hydrologic characteristics in the Smith River WAU.

Subbasin	Area ($miles^2$)	% WAU	Stream Miles	Stream Density
South Fork	8.8	11.4	73.5	8.35
Halfway	8.2	10.5	57.2	6.98
Panther	5.8	7.5	40.7	7.02
Cleghorn	5.1	6.7	43.8	8.59
Hardslide	5.1	6.6	39.3	7.71
Haney	4.9	6.4	34.3	7.00
Peterson	4.8	6.3	34.8	7.25
Paradise	4.3	5.6	41.0	9.53
Yellow	4.2	5.5	34.0	8.10
Tip Davis	3.7	4.8	21.4	5.78
Summit	3.1	4.0	22.2	7.16
Johnson	2.8	3.7	25.6	9.14
Beaver	2.7	3.5	21.4	7.93
Elk	2.6	3.3	20.9	8.04
Salmonberry	2.4	3.2	17.6	7.33
Amberson	2.3	2.9	17.3	7.52
Smith Front	2.0	2.6	12.3	6.15
Hefty	1.8	2.3	9.3	5.17
Plank	1.5	1.9	12.5	8.33
Smith 80	1.0	1.3	8.2	8.20
Total	77.1	100.0	587.3	7.62[1]

[1] Mean of total WAU, not mean of subbasins.

Table 4. Subbasin equivalent clearcut areas in the Smith River WAU				
Subbasin	Area (miles^2)	% WAU	% ECA less than 6 yrs.	% ECA less than 21 yrs.
South Fork	8.8	11.4	14	21
Halfway	8.2	10.5	21	27
Panther	5.8	7.5	0	14
Cleghorn	5.1	6.7	15	40
Hardslide	5.1	6.6	20	40
Haney	4.9	6.4	14	35
Peterson	4.8	6.3	9	14
Paradise	4.3	5.6	16	34
Yellow	4.2	5.5	11	69
Tip Davis	3.7	4.8	5	6
Summit	3.1	4.0	11	12
Johnson	2.8	3.7	13	28
Beaver	2.7	3.5	15	28
Elk	2.6	3.3	17	31
Salmonberry	2.4	3.2	16	22
Amberson	2.3	2.9	11	27
Smith Front	2.0	2.6	33	39
Hefty	1.8	2.3	17	18
Plank	1.5	1.9	9	17
Smith 80	1.0	1.3	0	7
Total	77.1	100.0	14 (avg.)	27 (avg.)

Road Density

Road densities for the subbasins within the Smith River WAU were compiled from existing GIS database themes (Table 5). Percentages of the area (mi.^{2}) of roads were computed using an average road width of 30 feet. The average road density in the subbasins is 4.1 mi./mi.^{2}; the overall road density in the WAU is 4.3 mi./mi.^{2}. Roads account for 2.4% of the WAU area, and average 2.3% in the subbasins (Table 5). While these figures are somewhat inaccurate (because of the presence of many unmapped roads and skid trails), they are nonetheless useful in assessing the hydrologic impact of roads in the subbasins. Hydrologic effects associated with increased road densities include decreased infiltration rates on all or parts of the road, and interception of subsurface flow (Wemple 1994, Fredriksen and Harr 1979, Megahan 1972). These studies document that decreased infiltration of rainfall and interception of shallow subsurface flow by roads is converted to overland flow and directed into roadside ditchlines and culverts, thereby significantly extending the channel network and increasing the efficiency of routing rainfall to the stream channels. The studies conducted by Wemple (1994) suggest that roads in the study area had extended the stream network by as much as 40% during storm events, and that the runoff collected by the roads were largely from interception of subsurface flow.

Intuitively, subbasins with higher road densities and a higher percentage of road miles to stream miles will likely have a greater number of stream crossing culverts and ditch relief culverts. Analysis of the number of road/stream crossings in each subbasin, however, does not indicate any such correlation. Research indicates that not only do these culverts increase the efficiency of routing rainfall to natural stream channels, but that this component of basin runoff is commonly laden with high levels of suspended solids (Johnson 1995). Many of the roads in the Smith River WAU were designed and constructed decades ago, are not in concurrence with current Best Management Practices, and do in fact introduce surface runoff carrying concentrated suspended solids (Olson, personal observations).

Table 5. Road and hydrologic characteristics in the Smith River WAU.

Subbasin	Area (miles^2)	% WAU	Road Miles	Road Density	% Road Area	% of Roads to Streams
South Fork	8.8	11.4	25.4	2.9	1.6	34.6
Halfway	8.2	10.5	48.7	6.0	3.4	85.1
Panther	5.8	7.5	19.0	3.3	1.9	46.7
Cleghorn	5.1	6.7	26.1	5.1	2.9	59.6
Hardslide	5.1	6.6	26.4	5.2	2.9	67.9
Haney	4.9	6.4	19.9	4.0	2.3	58.0
Peterson	4.8	6.3	15.1	3.1	1.8	43.4
Paradise	4.3	5.6	16.7	3.9	2.2	40.7
Yellow	4.2	5.5	25.7	6.1	3.5	75.6
Tip Davis	3.7	4.8	19.7	5.3	3.0	92.1
Summit	3.1	4.0	15.0	4.8	2.7	67.6
Johnson	2.8	3.7	16.1	5.7	3.2	62.9
Beaver	2.7	3.5	10.8	4.0	2.3	50.5
Elk	2.6	3.3	13.1	5.1	2.9	62.7
Salmonberry	2.4	3.2	6.6	2.7	1.5	37.5
Amberson	2.3	2.9	3.9	1.7	1.0	22.5
Smith Front	2.0	2.6	6.3	3.1	1.8	51.3
Hefty	1.8	2.3	10.4	5.9	3.3	111.8
Plank	1.5	1.9	5.0	3.4	1.9	40.0
Smith 80	1.0	1.3	0.1	0.1	0.1	1.2
Total	77.1	100.0	330.0	4.1 (avg.)	2.3 (avg.)	55.6 (avg.)

The percentage of road area in each subbasin has been computed and displayed (Table 5) to relate to research completed by Harr (1976). This study demonstrated that large peak flows in western Oregon appeared to be increased when between 8 and 12% of a basin was seriously compacted by road building, tractor skidding, or tractor windrowing of slash. While the conditions in the WAU subbasins do not approach this level of compaction, it should be noted that tractor skid trails are not available for this analysis.

The hydrology of the subbasins in the WAU has been impacted by timber harvest and road construction. Observed and measured data collected from the Upper and Middle Smith River WAU by the Oregon Department of Environmental Quality in 1988 indicate that there are moderate and severe water quality (sedimentation) and aquatic habitat (instream structure) problems. Additional data collected by the Oregon Department Fish and Wildlife, from aquatic habitat inventory surveys, has revealed instream conditions in Yellow Creek and Haney Creek that are symptomatic of increased peak flows and increased sedimentation. These conditions can be directly linked (cause and effect) to the processes illustrated in the previous sections of this report.

Disturbance Patterns Within the Watershed

Disturbance within the forest ecosystem is a natural part of stand and forest development. The time frames vary by the occurrence of events, e.g. - wildfire, windthrow, heavy rains causing slope failures, flooding, etc. Disturbance can be of two types - Stochastic events such as wild fire, avalanches, wind storms (tornados, hurricanes, etc); short term, naturally occurring events. Other longer term events such as climate change, glaciation and so forth have little short term impact on forested ecosystems. The second type of disturbance are those associated with human influences, such as timber harvesting, road building, land clearing, wild fire prevention. These disturbances tend to be more short term and dramatic in nature.

Fire History

In 1914, approximately 80% of the watershed was classified as "Merchantable Timber" (Figure 4). No data is available on District as to describe merchantability standards at the time. From historical discussions merchantability standards would be any tree greater than 24" DBH (diameter at breast height - 4.5 feet). The remaining areas are classified as "Burned areas - restocking" (approximately 5%) or "Burned areas - Not restocking" (approximately 14%). These were either underburns or areas where stand replacement fires occurred and natural regeneration is or is not occurring . Mature and old growth stands (greater than 110 years of age) occur on approximately 10,800 acres (Figure 4). They are primarily located in the "Merchantable Timber" area. Stands located in the burned areas are probably remanent stands.

The only other fire that influenced the Upper Smith River watershed was the Oxbow Fire in 1966. This was a human caused fire that originated in Oxbow Creek area and spread rapidly to the southeast. Approximately 3000 acres of BLM and private lands, in the western portion of the watershed, were influenced by this fire.

Windstorm

There were two significant windstorms that influenced the Roseburg District. First was the 1962 Columbus Day Windstorm and a significant wind event that occurred in 1974. No records were found that indicated how these storm affected the watershed.

Human Influenced Disturbance

The most significant disturbances within the watershed caused by human activity. The Roseburg District Archeologist indicated that use in the watershed dates to the 1860's. (see District Archaeologists Report in Appendix 2). Some timber harvest and "slashing" occurred during this period. Primary developments were homesteading and transportation.

The earliest recorded timber sale in the watershed was in 1938. The sale was located in Sec

12, T21S R6W. Volume sold was 1.2 MMBF. Major road building began in the late 1950's as a means to access public and private lands in the watershed.

Figure 5 shows current seral stage distribution in the watershed. Approximately 64% of the watershed is in the early or mid seral stage - less than 45 years old (Table 6). Most of the vegetative disturbance has occurred since 1950. Both human caused and naturally occurring events have influenced the current seral stage distribution. The predominant influence though on seral stage development has been timber harvest.

Private lands have contributed a significant portion of the timber harvest from the watershed, since 1945 (approximately 94% of the private land base). National factors, such as post World War II construction boom, helped to initiate the acceleration of timber harvest on private lands; improve logging technology; and increase wood utilization. BLM lands contain the majority of the mature and old growth seral component in the watershed (35%). This supports a large population of Northern Spotted Owls and provides the majority of potential Marbled Murrelet habitat within the watershed.

Table 6. Seral stage area, by ownership, in the Smith River WAU.

Seral Stage	BLM Acres	% of Total Ownership	Private Acres	% of Total Ownership	Total Acres	% of Total
Unknown	0	0	899	5	899	2
Non- Forest	0	0	236	1	236	< 1
Early	4045	13	3449	18	7494	15
Mid	12,341	40	11,849	63	24,190	49
Late	3375	12	2194	12	5569	11
Mature	7608	25	79	< 1	7685	16
Old Growth	3195	10	0	0	3195	7
Total	30,554	100	18,706	100	49,032	100

Climate

Weather patterns for the Smith River WAU are typical of the Maritime climate characterized by (Franklin and Dyrness 1973:42):

> 1) mild temperatures with prolonged cloudy periods, muted extremes, and narrow diurnal fluctuations (6-10 degrees C);
>
> 2) wet, mild winters, cool, relatively dry summers; and a long, frost-free season; and
>
> 3) heavy precipitation (typically 170 to 300 centimeters (67 to 118 inches) or more on the coast and 80 to 120 centimeters (31 to 47 inches) in the Puget-Willamette trough), 75-80 percent of which occurs between October 1 and March 31, mostly as rain.

Weather stations in Drain and Elkton receive, on average, 46.14 (117.19 centimeters) and 52.93 inches (134.44 centimeters) of rain, respectfully, each year; 80 and 83 percent occurring between 1 October and March 31 (USDC 1992) (Fig. 6). Monthly, average temperatures range from 66.7 and 68.1 degrees F (19.3 and 20.1 degrees C) [Drain and Elkton, respectively], in August; to 40.7 and 42.4 degrees F (4.8 and 5.8 degrees C), in January (Fig 6). The average, maximum temperature is 83.1 and 84.3 degrees F (28.4 and 29.1 degrees C), in August; the average, minimum temperature is 33.5 and 35.9 degrees F (0.8 and 2.2 degrees C), in January (USDC 1992).

Geomorphology

Geology

Two formations are represented according to the classification scheme of Ewart Baldwin which is currently adopted by the State of Oregon Department of Geology and Mineral Industries (Baldwin (1974) as cited in Niem and Niem 1990). In the southwest corner of the Smith River WAU (primarily the Halfway Creek subbasin) is the Tyee formation (undifferentiated turbidite[1]). It was deposited in the middle Eocene to a depth of five to six thousand feet and consists of well-indurated[2], thick to very thick-bedded cliff-forming, micaceous arkosic[3] sandstone and thin-bedded siltstone.

The remaining WAU (≈90% of area) is mapped as the Siuslaw member of the Flournoy Formation (turbidite facies[1]). It was deposited in the lower to middle Eocene to a depth to four to five thousand feet and consists of very thick-bedded, massive to graded fine-grained micaceous feldspathic [4] sandstone with minor sequence of thin-bedded siltstone and fine to very fine-grained graded sandstone beds and some very thick-bedded channelized sandstone.

Molenaar in 1985 maintained that the Flournoy and Tyee formations can not be differentiate in the Smith River area and consequently these two units should be mapped together as Tyee (Niem and Niem 1990).

A series of anticlines and synclines line up along the southern WAU. Their axis are oriented northeast to southwest (Fig. 7). Five faults along the northern WAU were inferred from attitudes and in one case, aerial photo interpretation. The dip of the strata beds is typically to the southwest in the western WAU. The dips are more variable in the eastern part of the WAU. The direction and degree of dip can be an important slope stability factor.

Topography: The topography ranges from the near level floodplains of the Smith River and its major tributaries to very steep, highly dissected mountain slopes with gradients commonly

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[1]turbidite: Turbitity current deposit giving in this case a dirty sandstone (mud mixed in).

[2]indurated: Hardened by heat, pressure, and/or cementation.

[3]arkosic: Referring to sandstone containing 25% or more feldspars derived from silicic igneous rocks.

[4]feldspathic: Referring to a sandstone containing 10 to 25 percent feldspar intermediate between a pure quartzoze sandstone and an arkosic sandstone.

to 90 percent. Headwalls, inner gorge slopes and cliff forming rock outcrop exceed 100 percent slope in many places. From a scan of the 7½ minute topographic quadrangles it appears that the southerly (southwesterly most commonly) side of ridges are generally less steep and less dissected than the northerly sides of the ridges. This relationship may be due to the dip of the strata influencing differential weathering.

Steep ground above 60 percent slope covers one half of the WAU and is most often the largest component of the western three fourths of the WAU. More gentle slopes dominate Summit Creek, Peterson Sleeze and Tip Davis Spring WAU. Large concentrations of slopes less than 30 percent occur along the Smith River corridor and Halfway Creek as well as the eastern one quarter of the WAU. (Fig. 8)

Elevations range from 460 feet at the lowest downstream portion of the Smith River within the WAU (SW¼ Sec. 1, T. 21 S., R. 8 W.), to 1850 feet on Peterson Point overlooking the South Fork of the Smith River (SE¼SW¼ Sec. 10, T. 21 S., R. 6 W.). The relief differences from ridgetop to valley floor are typically 600 to 800 feet in the western three quarters of the WAU and 400 to 650 feet in the eastern one quarter of the WAU. Relief differences as high as 1000 feet are present in a few places. This analysis area is entirely below the transient snow zone.

The following is a summary of the geologic/soils condition of the WAU as derived from the soil survey (Tables 7-15).

Table 7 . Slope class distribution within the Smith River WAU.		
Slope Class (%)	Area	
	(ac.)	(%)
0-3	2392	4.8
3-30	9489	19.2
30-60	11296	22.9
60-90	23322	47.3
No data (Lane Co.)	2847	5.8
Total	49346	100.0

Table 8. Landslide hazard in the Smith River WAU.		
Hazard Class	Area	
	(ac.)	(%)
Low (0-30 % slope)	11881	24.0
Medium (30-60 % slope)	11296	22.9
High (60-90 % slope)	23322	47.3
No data (Lane Co.)	2847	5.8
Total	49346	100.0

Table 9. Soil depth to bedrock in the Smith River WAU.		
	Area	
	(ac.)	(%)
Moderately deep-Shallow soils-Rock outcrop complexes (shallower average depths)	1006	2.0
Moderately deep-Shallow soils complexes (shallower average depths)	11365	23.0
Moderately deep soil mapping units and moderately deep-Very deep soil complexes (Medium average depths)	21347	43.3
Very deep soil mapping units (deepest average depths)	12781	25.9
No data (Lane Co.)	2847	5.8
Total	49346	100.0

Notes: shallow = 10-20 inches to bedrock; moderately deep = 20-40 inches to bedrock; deep = 40-60 inches to bedrock; very deep = greater than 60 inches to bedrock

Table 10. Predominant soil texture (subsoil) within the Smith River WAU.		
Subsoil Texture	Area (acres)	Area (%)
Loamy	14556	29.5
Loamy-skeletal	23372	47.3
Clayey	8571	17.4
No Data (Lane Co.)	2847	5.8
Total	49346	100

Generally the clayey soils are confined to the gentler slopes and are moderately deep to very deep. The loamy skeletal soils primarily occur on slopes greater than 30 percent and are primarily shallow and moderately deep in depth.

Table 11. Soil drainage within the Smith River WAU.		
Drainage	Area (acres)	Area (%)
moderately well and well drained	45949	93
somewhat poorly drained	142	0.3
poorly drained	408	0.9
No Data (Lane Co.)	2847	5.8
Total	49346	100

Somewhat poorly drained soils have a seasonable high water table near the surface. Poorly drained soils have high water tables at or near the surface for a considerable part of the year.

Table 12. Soil burn categories within the Smith River WAU.

Soil Burn Category	Area (acres)	Area (%)
Category 1[1] (highly sensitive)	23849	51.3
Category 2 (moderately sensitive)	6163	12.5
Category 3 (least sensitive)	9056	18.4
No Data	2847	5.8
Total	49346	100

[1] All shallow soils (less than 20 inches depth), all soils with less than 4 inches of A horizon, and all soils on slopes which exceed 70 percent slope.

Table 13. Available water to a soil depth of 20 inches, in the Smith River WAU.

Availability	Area (acres)	Area (%)
Low (< 2 inches)	12370	25.1
Medium (2-4 inches)	20274	41.0
High (3-4 inches)	13447	27.3
Variable (soil with high water tables)	408	0.8
No Data (Lane Co.)	2847	5.8
Total	49346	100.0

Note: There are overlapping capacities between the medium and high categories due to different combinations of soils within mapping units. One mapping unit may be a complex of a soil with an AW around 2 inches and another soil with an AW above 3 inches. Another mapping unit may have both soils with AW above 3 inches.

Available water in the top 20 inches has been used to help assess survival capabilities of seedlings in a particular soil.

Table 14. Available water capacity to a soil depth of 60 inches, in the Smith River WAU.		
Complexes	Area	
	(acres)	(%)
Very low and low (1.4 - 4 inches)	12370	25.1
Low, medium, high, and very high (3.0 - 11.0 inches)	21347	43.3
High and very high (7.5 - 11.0 inches)	12373	25.1
Variable due to high water table	408	0.8
No Data (Lane Co.)	2847	5.8
Total	49346	100.0

Available water in the top 60 inches is more appropriately used after successful seedling establishment.

Table 15. King 50 Year Site Index for Douglas Fir (average) within the Smith River WAU.		
Site Class	Area	
	(acres)	(%)
<100	1099	22.3
100-110	21805	44.2
110-120	15206	30.1
120-140	8070	16.4
No site index data	316	0.6
No Data (Lane Co.)	2847	5.8
Total	49346	100.0

III. DISCUSSION OF KEY ISSUES

The ID team brainstormed 28 issues that might be of importance within the watershed. Further discussion eliminated some ideas and combined others, in the end the ID team identified four key issues for the Smith River WAU: biodiversity, forest health, socio-economics, and fisheries/riparian condition.

A subgroup of the ID team was formed to address each issue. To assist each subgroup in developing their discussion the desired future condition (DFC) was identified and key questions (KQs) were developed to assist each subgroup in focusing their discussions.

ISSUE: Biodiversity

DFC: Increase the patch size of, and connectivity between the LS/OG stands (stand age 110 years and older) in LSR and to implement management that will minimize negative impacts to interior and LS/OG species on Matrix lands, while still meeting the objectives of the President's Forest Plan. Manage to benefit native species.

KQ: 1. What is the patch size and age class distribution?

2. What species are known to exist or are expected to occur within the watershed?

3. Where are there noxious/exotic species problems and what are their vectors of dispersal?

4. Where are and what types of special habitat features occur in the Smith River WAU?

ISSUE: Forest Health

DFC: Maintain vigorous and productive forests, minimize possibilities of large scale catastrophic events, provide for the forest's natural ability to withstand insect and disease infestation.

KQ: 1. What is the fire history and return interval for the forests of the Smith River WAU?

2. Where are disease and insect problem areas?

3. Where are their concentrations of skid trails, from past management practices that may impact site productivity?

4. Where are the TPCC withdrawals?

5. Where are the stands in need of density management and/or fertilization in order to remain vigorous and healthy?

ISSUE: Socio-economics

DFC: Provide sustainable production of economic commodities and social opportunities for a variety of public users; consistent with the President's Forest Plan.

KQ: 1. What is the public accessibility to the Smith River WAU?

2. Where are the recreational opportunities in the watershed?

3. Where are the commercial harvest opportunities in the watershed?

4. Who are the various user groups in the watershed?

5. What are the opportunities for special forest products use in the watershed?

6. What project needs will have to be contracted out to the community for completion?

7. Where are the known and potential archeological and cultural resource sites in the watershed?

ISSUE: Fisheries/Riparian

DFC: Maintain and restore stream, hydrologic, and riparian functions necessary to provide for the passage, spawning, rearing, and holding requirements of naturally occurring anadromous and resident fish species; aquatic vertebrate and invertebrate species; and riparian and LS/OG associated species.

KQ: 1. What are the beneficial uses of Smith River and its tributaries and their limiting factors?

2. What is the age class and species composition of the riparian reserve areas?

3. How many miles of roads and trails exist in the riparian reserve areas?

4. Where are there culvert and other fish passage problems?

5. Where are, and what size are the road related and naturally occurring landslide events?

6. Where are the potential unstable areas?

7. What is the road density in the WAU?

8. What is the distribution of aquatic and riparian associated vertebrate species?

9. What is the stream habitat condition?

10. What condition are the roads in the WAU?

IV. ANALYSIS OF ISSUES

ISSUE: Biodiversity

Watershed analysis was initiated for the Smith River drainage to meet the ecosystem management objectives stated in the standards and guidelines of the President's forest plan (USDI & USDA 1994). The focus of this report is to address the issue of biodiversity and habitat management for late-successional and old-growth forest- related species within the range of the northern spotted owl. This analysis of the biodiversity issue is not designed around the maximum genetic potential of the animals and plants found in the drainage, it is not defined or determined by the maximum number of individuals of each species known to exist or reside in the drainage, and it is not based on any statistical concept (i.e. like "Shannon Diversity Index") using either the habitat type or the plants/animals found in Smith River. Within the framework of ecosystem management and this paper the concept of biodiversity and its analysis will be based upon the present availability and the future condition of seven forested seral stages, and ways in which those seven habitats were and will be impacted by management actions. The focus of our paper is to examine the availability (Tables 16 and 17) and distribution of habitat (Table 18), potential wildlife species in the watershed (Table 19), potential impacts to wildlife by management actions (Table 20), list potential ways biodiversity is being impacted by management actions, and finally to suggest some ways in which we can reduce management impacts to biodiversity within the Smith River drainage.

Given the preponderance, i.e. approximately 99%, of the non-federal lands in the watershed are in a younger seral stage (Table 16), further discussion and analysis will focus on the federal lands as the older seral stages (i.e. large saw, young OG, and old OG) will probably never occur on non-federal lands in meaningful and predictive manner.

Table 16. Seral stage distribution of forested stands on non-federal lands within the Smith River WAU.				
AGE CLASS	ASSOCIATION	# PATCHES	SIZE (ac.)	%
0-5	grass/forb	26	1354	7.8
6-14	shrub	20	1257	7.3
15-24	pole	13	1198	6.9
25-74	small saw	40	13318	77.1
75-114	large saw	2	74	0.4
115-194	young OG	5	79	0.5
195+	old OG	0	0	0.0

Table 17. Seral stage distribution of forested stands on federal lands within the Smith River WAU.				
AGE CLASS	ASSOCIATION	# PATCHES	SIZE (ac.)	%
0-5	grass/forb	28	1032	3.4
6-14	shrub	67	2055	6.7
15-24	pole	75	4068	13.3
25-74	small saw	92	9866	32.3
75-114	large saw	45	2221	7.3
115-194	young OG	74	7694	25.2
195+	old OG	33	3592	11.8

On federal lands the habitat distribution is bimodal. The younger mode representing approximately 46% of the land (ages: 6-14 and 15-24) and the older mode having 37% of the land (ages: 115-194 and 195+), with the younger stages being represented by a more equitable proportion of the land base, than on private. Within the framework of the watershed the older age habitat patches are fragmented and loosely connected, due to the checker board ownership and previous management activities. Presently, there are 85 ecologically distinct patches of older age habitat (equal to or greater than 74 years of age); 69% of the patches are relatively small in size (Table 18).

Table 18. Number and patch size distribution of older age habitat (equal to or greater than 74 years of age) on federal ownership in the Smith River.		
PATCH SIZE (ac.)	NUMBER	AVERAGE SIZE (ac.)
5-26	32	11
27-64	27	46
65-100	9	83
101-250	8	155
251-600	6	438
601+	3	1399

Table 19. Potential wildlife species of general interest, identified during the scoping process:	
SENSITIVE SPECIES	OTHER SPECIES OF CONCERN
Northern spotted owl	Elk and deer
Marbled murrelet	Pacific fringe-tailed bat
Bald eagle	Clouded salamander
White-footed vole	Red-legged frog
Townsend's big-eared bat	Northern goshawk
	Pileated woodpecker
	Northern saw-whet owl
	Osprey
	Neotropical passerines
See Marshall, et al. (1992) for the discussion on the biology of the above species.	

The watershed has many functions, among them is the designated use and management of

T&E species. There are presently 12 known spotted owl sites in the drainage, and no known marbled murrelet or bald eagle sites. Management of the spotted owl and marbled murrelet reserve areas will be guided by the Northwest Forest Plan and locations of the Late-successional Reserves (LSRs) for owls and murrelets are designated in the Northwest Forest Plan. In addition, some of wildlife species listed in Table C-3 and identified in the Northwest Forest Plan (i.e. S&M species, USDA and USDI 1994a) may be present in the watershed.

One of the variables that increases and maintains productivity in the ecosystem is soil depth to bedrock (Table 9, Fig. 11). With a range of values (i.e. depth) and conditions (i.e. geomorphology) there are a variety of substrates produced, which in and of itself dictates which plant community establishes itself. Also, within confines of this substrate is the soil (particularly the A horizon) and how its ecological complexity is highly correlated to productivity (Personal communication Moldenke). Therefore, when conditions or actions change or limit this variable and its availability, for example, as in a landslide(s), then consequently there will be an overall decrease in the biodiversity and productivity of the watershed (Table 9, Fig. 10). Simply, when we increase the probability of a landslides, we potentially decrease the overall potential of that land ---- which in turn limits the options available to the parcel of land, and subsequently the overall potential biotic diversity within the watershed.

Table 20. Potential consequences to special status species and a few other species of general interest known to occur within the drainage that may be impacted by ground disturbing activities.

SPECIES	SURVEYED FOR	PRESENT	IMPACTED	POTENTIAL IMPACTS FROM GROUND DISTURBING ACTIVITIES
Spotted owl	yes	yes	yes	modification of suitable and dispersal habitats
Marbled murrelet	yes	no	no	modification of suitable habitat
White-footed vole	yes	yes	unknown	modification of suitable habitat
Townsend's big-eared bat	no	no	no	not roosting habitat and hibernaculum
Deer	yes	yes	yes	modification of forage and bedding habitat
Elk	yes	yes	yes	modification of forage and bedding habitat
Osprey	yes	no	no	modification of perching and nesting habitat near river
Neotropical passerines	yes	yes	yes	modification of nesting and foraging habitat

ISSUE: Forest Health

Insects and Disease

Disease is at purely endemic levels. Scattered pockets of both root rot and black stain can be found. Where both diseases are found in the same pocket, an opening of up to an acre in size can occur. These openings are few and far between and are no threat to forest health.

Density Management

Thinning maintains a forest stand in healthy vigorous condition. where proper density is not maintained, stands become stagnant, slow growing, and more vulnerable to disease, insects, drought, and windthrow. Density management occurs at age 10 to 20 as precommercial thinning (PCT) and again at age 35 to 55 as a commercial harvest (Table 21).

Fertilization

Fertilization has been shown to increase growth of a stand significantly for 15 years after fertilization. Available nutrients are the main growth determining factor in young stands. Thinning shock is also significantly reduced when fertilized. One thousand three hundred seventy-three (1373) acres are available for fertilization (Table 21).

Fire

The Oxbow fire occurred in 1966. It burned over 50,000 acres, approximately 3000 acres are in the Upper Smith River WUA. Most of the burn was on Coos Bay District. About 1700 acres are on Roseburg District lands.

Table 21. Forest conditions in the Smith River WAU[1].

Treatment	Completed	Needed
Pre-commercial thinning	4719	6053
Commercial thinning	20	3440
Fertilization	2722	1373[2]

[1] Roseburg District only.
[2] Units that have been PCT'd but not fertilized.

Note: Data derived from the District's Micro*storms silvicultural database.

Forest Soils

Management of the forest in the WAU has to varying degrees resulted in adverse impacts to the soil health both on BLM and private land. These impacts may be listed as compaction, accelerated erosion and landslides, alterations of the soil due to hot prescribed burns and the mechanical removal of topsoil. They reduce the amount of soil present and alter its important physical and chemical properties for plant growth and the soil fauna. The soil fauna (in particular, the microbial and invertebrate populations such as springtails, centipedes, and oribatid mites) are vital in nutrient cycling, retention and availability and their byproducts such as humus are important binding agents in the formation and maintenance of soil structure.

Soil compaction from ground based operations can significantly reduce forest productivity and its persistence can last 40 years or more. Forest productivity correlates with soil ecological complexity (60 to 80 percent of the soils biodiversity is in the upper soil and litter). When this complexity and number of organisms are reduced, soil degradation follows and recovery can be slow. In forest soils fungal populations are normally much greater than bacteria. In an environment where at least a ten fungus to one bacteria ratio is not maintained, trees and seedlings will not grow. Much is known about its effects on soil aeration, water availability and root penetration but now researchers are beginning to understand its effects on the soil fauna. Black stain disease centers are most often associated with site disturbances and stress conditions in precommercially thinned stands, especially adjacent to skid trails and roads.

Besides its impacts on water quality, landslides can greatly reduce a site's productivity by stripping away much or all of the soil.

Impacts of Skid Trails in the WAU to Forest Health

Discernable areas of skid trail concentrations in the Halfway Creek and Johnson Creek WAUs were mapped using the aerial photo record from 1959 to 1994 (Fig. 18). The amount of activity discernable from the 1970 and 1994 aerial photos (1989 photo used in place of 1994 photos still not on file) was also identified. These were noted on the attached one inch to the mile road map (Fig 19).

Findings:

1. A high percentage of the ground under 35 percent slope was cat logged throughout the WAU. (Almost 30% of the WAU outside of Lane County is on slopes under 35 percent. The largest areas of slopes under 35 percent are along the Smith River corridor, along Halfway Creek and the South Fork of the Smith River and the three eastern most subbasins - Peterson Sleeze, Summit Creek and Tip Davis Spring).

   About two-thirds of these slopes in Halfway and Johnson Creek WAUs were cat logged clearcuts or had extensive skid trails in mature and old-growth forest (salvage type operations. Nearly all of the less-than-35% ground was impacted in the Hard Slides subbasin.

2. A fair percentage of ground from 35 to 60 percent was also impacted by skid trails and cat yarding. The soil scientist does not have a good handle on the extent but some localized areas were hit pretty hard.

3. On slopes less than 35 percent skid trail density was generally high (less than 150 feet average spacing in all directions). The density was considerably lower on the steeper slopes but large amounts of blading was necessary and grades were characteristically steep most likely resulting in significant soil segregation and erosion losses.

4. In Halfway Creek and the Johnson Creek WAUs about 60 percent of the mapped clearcut cat operations and about 85 percent of the mapped salvage type operations in mature and old growth occurred prior to August 1970.

5. A very high percentage of skid trails appear to have revegetated so that erosion is no longer a big factor.

6. Where the earlier ground-based operations occurred, some degree of residual compaction can be anticipated. An inspection of a tract of trees 25 years old in the NW¼ Sec. 27, T. 21 S., R. 6 W., in the bordering Tom Folly watershed showed much of the skid trail area to be well on the way to recovery in the top seven inches with residual compaction being slight. The surface structure was blocky breaking to granular. Compaction of the upper subsoil was moderate. The trees in the trails appeared to be of comparable size of those outside the trail. However, the average spacing of trees within the trails was much wider. An apparent log deck area still was severely compacted, and the trees were small and stressed. Nearly all log deck and landing areas the soil scientist has encountered are still in a severe compacted state despite their age. He has been to other old sites where a lot of the trails still have heavy compaction.

A small percentage of the high density skid trail tracts logged prior to 1970 have recovered sufficiently to pass the 1% productivity loss criteria. Only a very small percentage of the younger tracts would meet the criteria.

Impacts of Landslides in the WAU to Forest Health

Landslides which occurred in Halfway Creek and Johnson Creek WAUs from about the mid 1950s to July 1994 were mapped (Fig. 20), spot symbols were then used to plot the landslides [5] discernable from the 1970 and 1994 aerial photos (1989 photos used in place of 1994 photos not on file) on the attached one inch to the mile road map (Fig. 19). Included were two slides known to have occurred in January 1995. The landslides which still exhibit appreciable areas of unhealed scars are shaded orange.

Findings:

1. The findings are similar to those of Tom Folly and Mid-Umpqua Frontal. The statistics in the soil scientist's Tom Folly report would probably be representative of Smith River.

2. The most common types discernable from the aerial photos are shallow translational types - debris avalanches and earth flows. Debris torrents which carry long distances down drainage bottoms were often in combination with them.

3. Those slides caused by roads were the most common and comprised by far the biggest component of the large sizes. Those associated with young clearcuts comprised most of the rest.

4. The slides strongly correlate with slope steepness. (Fig. 10) There does not seem to be a strong correlation between the dip of bedrock strata and slides for the shallow translational failures. The direction of dip is probably important for deep seated failures.

5. Ninety-seven slides were identified in the 1970, 1989, (1989 aerial photos were only used where 94 photos were still not on file) and 1994 photos. Many landslides scars heal fairly

[5] Landslides greater than 0.1 acres in size.

quickly from a revegetation standpoint (often within seven years) and therefore the count only covers periods totaling about 14 years. Those scars which still pose a possible erosion problem (spot symbol on road map shaded orange) total 18. One overlooking the Little South Fork of the Smith River (a large deep-seated slide has slipped significantly and the whole mass is threatening to break away. The impacts to the South Fork would probably be significant if it were to do so.

6. The period of the most frequent and largest failures seem to be the 1960s and 1970s when road construction was moving more from drainage bottom locations to upslope roads which frequently crossed very steep headwalls or whose sidecast and drainage emptied into the headwalls from ridgetop positions. Sidecasting large amounts of cut material was the accepted practice of the time and contributed greatly to landslides.

   Landslide activity dropped off quite sharply as the 1980's progressed into the 1990's. Presumably due to less and better road construction practices, less timber harvesting and a number of drought years. This winter with some pretty significant rain events saw an increase in slide activity. One slide occurred on Weyerhaeuser spur AJ-1 through BLM land in the Salmonberry Creek subbasin (N½NE¼ Sec. 31, T. 20 S., R. 6 W.). The slide was the result of the road crossing a very steep headwall where seeps occurred below the road and where hard, non-fractured bedrock formed an impervious layer. New earth flows along the toe of the slumped BLM waste site in the SE¼ Sec. 15, T. 20 S., R. 7 W. have entered a tributary of Haney Creek and their raw, steep surfaces are eroding. Another slide was a ridgetop road related failure which caused a debris torrent that scoured down to hard non-pervious bedrock. It is clearly visible from the Smith River County Road. A number of small cutslope failures occurred along the Smith River Road.

7. Soil removed and bedrock exposed does translate into productivity losses some slow in healing, some permanent. Relatively sterile subsoils are slow in building humified organic matter, nitrogen and a healthy soil ecology. Many will support trees but probably at reduced capacities. Other soils are left too shallow and support only grass, forb, and shrub communities. There has been enough cumulative slide activity due to forest management

activities that the productivity loss has some significance to the total forest health issue.

Impacts of Erosion in the WAU to Forest Health

Aerial photo history indicates that a large percentage of steep ground in the Smith River WAU was downhill logged to roads built at or just above creek bottoms. Most of this activity occurred prior to about 1965. In many cases cat skid trails extended from the roads up draws feeding into the creeks until the draw gradient became too steep. Roadcut material was sidecast directly into the creeks. In many cases the operations appear to have been a combination of downhill and cat logging. Cleghorn and its tributaries are a good example of this (Fig. 21).

The erosion, sedimentation and streambank sloughing was very high in the riparian zones under these systems. Over a relatively short time the scars vegetated over most typically with red alder. Today erosion in these riparian areas are in nearly all cases not a problem. There probably have been to a degree of productivity loss. The alder should be doing a lot in restoring nitrogen.

On the 1 inch to a mile road map of the WAU the spot symbol DB identifies area that were logged this way on the 1970, 1989 and 1994 photos (Fig. 19).

Not many big road problem areas on BLM surface or BLM roads through private surface from the aerial photo record could be identified. In a comparative sense the erosion problem is probably considerably less than when many impacting roads were being built in the 1960s and 1970s. Still roads today are probably the biggest source of sediment. There just is not the abundance of big point sources as in the past.

The number of clearcuts younger than three years and new roads through the early 1990s has been relatively small and the cumulative in-unit erosion was probably not significant. The trend seems to be for increased erosion and sediment as the new wave of road construction and logging progresses. Currently there is quite a bit of activity in the north-central part of the WAU. The cumulative level will be well below historic peaks. Erosion from roads would still continue to be a major problem.

Impacts of Prescribed Burns to Forest Health

Prescribed burns have been a common practice on Federal lands with in the WAU. An incomplete analysis of Micro*Storms records identified 22 acres of pile burning, 225 acres of spot burning, and 566 acres of broadcast burning between 1961 and 1993. Burning on private lands is thought to have been considerably less (estimated at 10 percent of the logged area).

The District soil scientist estimates that one-half of the prescribed burns monitored for impacts to soil failed, based on the criteria set during the previous MFP. Principal impacts were: excessive loss of litter, woody debris, organic matter and nutrient capital, and the destruction of aggregate soil stability. The loss of aggregate soil stability resulted in accelerated ravelling, erosion and some landslide activity. Disrupting the soil ecology affected nutrient cycling.

The soils at greatest risk to burning are those:

1) on slopes greater than 70 percent;

2) have shallow depth to bedrock (≤ 20 inches) or thin topsoils (< 4 inches) or topsoils low in organic matter (ochric epipedon);

3) have a coarse texture or high rock fragment content (35 percent or more by volume);

4) have moderately deep depths to bedrock (20-40 inches);

5) have thin or spotty, dry litter layers;

6) have heavy loads of dry slash, especially in draws; and

7) have low soil moisture content, soils on steep, convex, south facing slopes dry quickest.

Risk factors 1 and 2 are associated with Category 1 soils (those especially sensitive to burning). Risk factors 3 and 4 are associated with Category 2 soils (those moderately sensitive to burning) (Table 12, Figure 14).

ISSUE: Socio-Economic

One of the tenets of all forest management/land use plans has been that Federal ownership would contribute to the stability of communities within the region. Several studies (Darr and Fight, 1974; Schalwau and Polzin, 1982; Sessions, et. al 1990) have shown that Douglas County is one of the most timber dependent counties in Oregon. Douglas County is a net exporter of timber to other timbersheds (Sessions, et.al 1990). In Timber for Oregon's Tomorrow, Sessions, et al.(1990) indicate that over-all timber harvest for the period 1968 to 1987, has declined. This decline has been almost 17% since the 1976 OSU study (Beuter et al. 1976 as cited in Sessions et. al 1990). Darr and Fight(1974) projected a decline in harvest for Douglas County over the next 30 year period. Primary reason given was an expected decline in harvest on private lands. Recently, a decrease in timber harvest off of all Federal Lands has led to an increase in timber harvest off of private lands in the County.

Timber supplies from BLM lands in the watershed will not approach previous levels. The Aquatic conservation strategy identified by the Northwest Forest Plan (USDA and USDI, 1994) indicate that watershed rehabilitation and restoration are the primary goal in Key Watersheds.

Access

The watershed has public access via Douglas County Road 37, located approximately 5 miles northeast of Drain, OR. This road follows Smith River from it's headwaters to the ocean. Access and maintenance from Mile Marker 27.9 to the U.S. Highway 101 is controlled by the Bureau of Land Management, Roseburg and Coos Bay District Offices. Primary access is a public 2-lane or single lane blacktop road. The BLM maintains the South Fork Smith River Access Road, a single lane blacktop road, that follows the South Fork of Smith River to the confluence of Little South Fork and Smith River in T20S R06W Section 31. This is public access road. There are also numerous rock spur roads that provide public access to adjacent BLM managed and private lands.

A recent study by the Oregon State Office reviewed access in terms of meeting the goals of the Presidents Forest Plan. Attached are the results of that study. In summary, BLM has control of approximately 51% of the existing road system. The majority of the system is within existing Right-of-Way agreements. BLM has no discretionary authority over a majority of the roads. As a result of this study, it was found that BLM could close approximately 7 miles of existing roads, less than 1% of the total existing road system (Appendix 2).

If the road system is to be reduced, permittees under current right-of-way agreements need to be contacted, and permission obtained before any road within the watershed can be decommissioned. This would appear to be a very extensive process.

Recreation/VRM

VRM--The watershed falls within VRM class III. Management activities may attract attention but should not dominate the view of a casual visitor.

Wild and Scenic River--The watershed does not fall within a designated National Wild and Scenic River area. Smith River was assessed for suitability as part of the National Wild and Scenic River system. It was determined to be unsuitable.

Recreation--The watershed lies within the Tyee Extensive Recreation Management Area. The Gunter Wayside is the only existing developed recreation site within the this area. Other recreation within the area is dispersed (hunting, fishing, recreational driving and primitive camping).

The Roseburg PRMP/EIS identified the Smith River Road as a proposed *Back Country By-Way*. Due to negative public pressure and conflicts with other proposed byways in the area, the request for designation is currently a low priority. It should be considered in future management plans as a possible addition to the Back Country Byway system.

There are no other identified immediate or long range plans for extending recreational opportunities in this area.

Human Uses

Past Use--There has been no comprehensive inventory of cultural resources done in the area. There is evidence of prehistoric and historic use in the area. Use by Native Americans is relatively obscure at present.

Historic use began in the 1860's. Early settlement of the area was associated with homesteading. Historical uses included farmsteads, cabins, roads, trails and bridges, industry (primarily sawmills and logging), schools and administrative sites (post offices, forts). Eighty-six percent of the 49 known historical sites in the watershed appear on BLM managed lands (see Archeologist's report, Appendix 2).

Current Use--Current human activity within the watershed is related primarily to timber harvest activity and recreation. The primary recreational activities include hunting and fishing. Little data exists on the amount of activity associated with recreational activities.

Private lands comprise 18,750 acres (about 38%) of the watershed. The majority of these lands are managed by forest industries. These are lands that are managed intensively for wood products. There are a few small, private, non-industrial forest lands and residential owners located along Smith River County Road.

Commercial Forest Products

Timber Products

Since 1989, approximately 7087 acres within the watershed have been harvested for forest products. This amounts to 14% of the watershed. Table 22 represents the harvest acreage by ownership.

Table 22. Harvest within the Smith River WAU, by ownership, between 1989 and 1994.		
Private	3043 acres	16 percent
Bureau of Land Management	4044 acres	13 percent

BLM has harvested approximately 13% of the 30,594 acres of land it manages in this time period while private landowners have harvested approximately 16% of the 18,751 acres in their ownership in the same time period.

SPECIAL FOREST PRODUCTS

A variety of special forest products are available in the Upper Smith River Watershed. These include salal (*Gaultheria shallon*), evergreen huckleberry(*Vaccinium ovatum*), dwarf Oregon Grape (*Berberis nervosa*), sword fern (*Polystichum munitum*) and beargrass (*Xerophyllum tenax*) (used in the floral greens industry); aromatic oils from Western Red Cedar (*Thuja plicata*) and Western Hemlock (*Tsuga heterophylla*); Cones are gathered for seeds and decorative greenery. There are many more uses and products described in the report on Special Forest Products dated April 17, 1995 (attached).

Data from 1989 indicates that the floral greenery and Christmas ornament industry spent and estimated $47.7 million on product acquisition, on a regional basis (within Oregon and Washington). The annual growth rate of this industry is approximately 3% per year. BLM has generated sales of $4,900 since October 1, 1994 (to April 14, 1995). Permits are sold at 10% of market value.

ISSUE: Fisheries/Riparian

Water Quality

The Clean Water Act, as amended, directs federal agencies to comply with state water quality requirements to maintain and restore water quality necessary to protect identified beneficial uses (USDI 1994) The state of Oregon has identified beneficial uses and applicable water quality criteria for the Umpqua basin (ODEQ 1986:16-19). The Oregon Department of

Environmental Quality (ODEQ) has also identified rivers or streams that are limited with regards to different water quality parameters. No streams within the Upper Smith River WAU are considered to be water quality impaired (as designated by ODEQ).

From a federal land managers point of view, the two priority water quality parameters within the Smith River basin are water temperature and non-point source (NPS) pollution (i.e. sedimentation). Oregon's NPS management plan requires the BLM to continue coordination with ODEQ for implementation of Best Management Practices (BMP's) which are intended to protect the beneficial uses of water (USDI 1994). The current ODEQ water quality standard for turbidity is that no more than a 10 percent cumulative increase in natural stream turbidities shall be allowed, as measured to a control point immediately upstream of the turbidity causing activity.

Current EPA criterion for protection of freshwater aquatic resources as related to temperature is based on "the important sensitive species" present during the time of concern. This is based on two extreme upper temperature limits, with the first being a short-term exposure (i.e. minutes) and the second based on a weekly maximum average temperature, which changes with season, reproductive stage, maintenance of species diversity, or prevention of nuisance growths of organisms (U.S. EPA 1986). The calculated values for maximum weekly average temperatures for growth and short-term maxima for survival of juveniles and adults during the summer for coho salmon are 64° F and 75° F. For rainbow trout these values are 66° F and 75° F respectively (U.S. EPA 1986). A summary of reported values for maximum weekly average temperature for spawning and short-term maxima for embryo survival during the spawning season for coho salmon are 50° F and 55° F. For rainbow trout these values are 48° F and 55° F (U.S. EPA 1986).

There is little data available related to temperature and salmonid survival specific to the Smith River basin (McCullough 1993). Present ODEQ temperature standards for the Smith River Basin are a 2° F allowable increase in water temperature at 56° F or less, a 0.5° F increase at 57.5° F or less, and a 0° F increase at 58° F and above. Changes in the state water quality standard for temperature have been made or are being proposed. One change which is definite is that the allowable increase will now be based on a 7-day running average of maximum temperatures rather than the current annual maximum. Other changes are probable, however at this time these are not certain.

Throughout the Upper Smith River basin, temperatures vary depending on the size of stream, water flow, the amount of harvest within the compartment level drainage and the current canopy cover. At the present time, there is virtually no past temperature data available and very little current information for the drainage exists. In general, however, it is reasonable to say that first to fifth order streams with a closed overstory canopy can maintain the cool temperatures required by salmonid fish species and other aquatic residents. Where canopies are open or non-existent, stream temperatures may reach lethal limits to salmonids during the hot summer months. In sixth order and larger streams, such as the mainstem of Smith River, there is no potential for full canopy closure. In these areas, summer temperatures may be such that many aquatic species cannot live in them. Thus, it is very important to protect the temperature regimes of the smaller tributaries in order to provide refugia during the summer months. Water temperatures between the months of October and late May generally do not exceed preferred levels for most aquatic organisms.

There is a lack of data on turbidity levels within the Upper Smith River basin. It is apparent, however that past land management activities, primarily logging and road building, have caused increases in the amount of sediment delivered to the stream network. In general, the Upper Smith River basin shows signs of high turbidity levels from November until May when the rains normally occur. High turbidity levels are noted particularly during and immediately after large rain events, but decreases are common within one or two days after the rains subside. These increases and decreases continue throughout the winter and spring months. Under the current Forest Plan, federal land managers will be retaining buffers of 150 to 450 feet depending on the stream classification. Roads are also being stabilized or closed in order to reduce the failure potential. All of these protection measures combined should reduce the potential for sediment increases in the future.

Riparian Zones

Much of the health of a watershed can be determined by its ability to effectively capture, store and release water. These processes are regulated by topography, rock and soil types, upslope vegetation, and the riparian area, and are highly influenced by upland activities such as timber harvest and road building. (Marcus, et al. 1990).

The riparian areas associated with the analysis area streams are necessary for water storage and maintenance of water quality. Water storage is critical and occurs predominately in areas where gradients are low and the topography is wide. The most important areas for water storage are on upland benches with deep soils and pools in the stream channel created by large woody debris, beaver dams or log jams. Large upland benches store water high up in the drainages which allow for long term cool water releases into the surrounding forest soils and eventually to the stream system. Water stored in stream pools cause the surrounding riparian soils to become saturated as the water table rises. These pools also allow coarse and fine sediments to drop out of the water column, thus assisting in the building of gravel bars and in sediment reduction. Through time, these sediment buildups have maintained the hydrologic connection between the stream channel and the floodplain. The water stored in these areas also provides for extended subsurface cool water releases farther into the hot summer months. Cool water temperatures are extremely important when considering the biological dependents of the stream (fish, invertebrates, amphibians). The riparian areas also aid in the maintenance of cool water temperatures through topographic and vegetative shading (both trees and shrubs). In addition, the surrounding vegetation and floodplains serve as energy dissipation structures during flood events consequently helping to reduce stream bank erosion and buffer nonpoint source sediment inputs.

Not only are riparian areas important from a hydrologic standpoint, but also for inputs of coarse woody debris for instream habitat for fish, organic debris for detritus feeding invertebrates, and nutrient cycling (Marcus, et al. 1990). The riparian areas, and their adjacent streams, likewise provide corridors for animal movement including terrestrial and aquatic mammals, birds, amphibians, reptiles, invertebrates and fish. Their importance to botanical species has not yet been fully recognized, but there can be no doubt that these areas provide habitat for many unique and ubiquitous plants.

The current existing riparian conditions in the Upper Smith River drainage vary from second growth and old-growth areas containing large conifer trees with a few hardwoods to alder dominated areas with young Douglas-fir (10-30 years old) on the hillslopes (Table 23). Salmonberry appears to be the dominant understory brush species in alder-occupied sites while sword fern is most common where Douglas-fir is present. Willow exists in large amounts generally in the vicinity of beaver dams. The distribution of second growth and old-growth fir stands exist primarily on federal lands while alder dominated riparian areas occur on both federal and private lands. Any of the alder dominated areas will cause a delay in large woody recruitment to the stream and riparian area for one hundred years or more due to the lack of conifer seedlings in the understory. The current instream and riparian structure (large wood) is created primarily by residual logging slash.

Roads existing within riparian reserves greatly influence the surrounding vegetation and several stream processes. In addition to the direct loss of vegetation within a road prism, road construction typically results in deciduous trees, such as red alder, replacing conifer trees, thus reducing the amount of large woody debris produced within the riparian zone. Further, roads have been placed directly adjacent to streams, constraining the natural meander, resulting in simplification and straightening of the channel. This simplification process leads to loss of aquatic habitat. Ground water storage capacity is compromised by the effects of soil compaction associated with the road system. The total number of roads within riparian reserves of third order and larger streams is estimated to be approximately 65 miles throughout the basin. Information on roads in riparian reserves on first and second order streams is not available at this time, but could easily double the above estimated figure.

Table 23. Riparian acres and percent ownership by riparian condition for third order an greater streams.in the Smith River WAU.						
Riparian Condition	BLM Acres	Private Acres	Total Acres	Percent BLM	Percent Private	Total Percent
60+ years, mixed stand, closed canopy	1,945	600	2,545	23%	7%	30%
15-60 years, mixed stand, closed canopy	1,018	1,237	2,255	12%	14%	26%
Hardwood dominated, closed canopy	1,655	1,090	2,745	19%	13%	32%
<15 years old, open canopy	509	491	1,000	6%	6%	12%
TOTALS	5,127	3,418	8,545	60%	40%	100%

The ROD offered various sets of widths for determining preliminary riparian reserve boundaries with the most restrictive or widest boundary as the one which should be applied before site specific analysis.

For the purpose of this analysis only, first order streams were assumed as all being intermittent, second order streams all as perennial non-fish bearing streams, and all third order and greater as fish bearing. The riparian reserve boundary was then corrected to horizontal distance (Table 24).

Table 24. Riparian reserve widths on Federal lands within the Smith River WAU.	
Intermittent Streams= First order streams	177.5 feet (either side of the stream)
Perennial Non-Fish Bearing = Second order streams	177.5 feet (either side of the stream)
Perennial Fish Bearing= Third order and greater	355 feet (either side of the stream)

Riparian management area (RMA) widths for private lands would follow Oregon Forest Practices Act regulations and guidelines. These widths are substantially less than Federal requirements (Table 25).

Table 25. Riparian management area widths (in feet) for private lands in the Smith River WAU.

Stream Size[1]	Fish Use or Fish and Domestic Use Together	Domestic Use Only	No Fish or Domestic Use
Large	100	70	70
Medium	70	50	50
Small	50	20	none

[1] Stream size is based on average annual precipitation and the area drained by a stream. Additional information may be found in 1994 Water Classification and Protection Rules Landowner/Operator Reference Guide, Oregon Dept. of Forestry-Forest Practices (pg.2-8,9).

Fisheries

Distribution/ Occurrence--There are a variety of anadromous and resident fish that occur within the Upper Smith WAU , all of which are native. The anadromous stocks include the Fall chinook salmon, coho salmon, winter steelhead trout, sea-run cutthroat trout, and Pacific lamprey. Common resident fish found in the WAU are cutthroat trout, brook lamprey, and a diversity of dace and sculpin species.

Anadromous salmonids that directly utilize the tributaries for spawning and/or rearing within the WAU are coho salmon, winter steelhead, and both forms of the cutthroat trout. Fall chinook are primarily found in the few available spawning areas on the mainstem of Smith River below Panther Creek. Juvenile chinook are generally not observed as they migrate downstream to rear in the estuary environment upon emerging from the gravel. The current knowledge of the distribution of chinook is therefore limited to those areas which have been monitored through the use of spawning surveys.

Coho and winter steelhead penetrate deep into the smaller tributaries with steelhead accessing the higher gradient areas that are unattainable to coho. Steelhead generally spawn in lower gradient or flat areas (roughly 2-5% gradient) of high gradient streams (third and fourth order streams). Both species rear for approximately one to two years in fresh water before migrating to the ocean. It appears for coho that deep pools with cover and side channels are critical for overwintering (Marshall, et al. 1992). Coho and steelhead in all life stages have been found throughout the basin through the use of spawning surveys and through direct observation. It is generally believed however, that the basin has not reached full seeding capacity for either species (ODFW 1993). Additional spawning and juvenile surveys should be completed throughout the drainage in order to determine the locations of high quality spawning and rearing habitats. Completing these surveys would also aid in the determination of streams lacking in those required habitats.

Little is known about the sea-run cutthroat trout, and outmigrating juveniles are virtually indistinguishable from the resident form. Spawning and early juvenile rearing is generally in the smaller, high gradient streams (second and third order). They also spend a considerable amount of time in estuary environments (Marshall, et al. 1992). Deep pools with large amounts of cover appear to be critical for cutthroat while in the freshwater environment (ODFW 1994). No information on cutthroat trout is available within the Upper Smith River basin. Additional data should be collected in order to determine the current and potential distribution of cutthroat in the basin.

Resident fish, as their name implies, are species which spend their entire life cycle in fresh water. There is little information about the resident fish that occur within this drainage. As stated before, sea-run and resident cutthroat trout juveniles are virtually indistinguishable from one another. Cutthroat have a very wide distribution throughout the Tyee Resource Area and can be found in virtually any tributary with perennial flow. Many have also been found in tributaries above natural migration barriers such as bedrock falls. It is expected that cutthroat would be found in the same types of locations throughout the Upper Smith River watershed as well (3-6" cutthroat have been found in Mosetown Creek- a Smith River tributary just west of the boundary of this watershed analysis). The Western brook lamprey, redside shiner, speckled dace, and four species of sculpin (Coast Range, prickly, riffle and reticulate) are likely to have a wide distribution within the analysis area. Little attention has been given to these species in the past, but it should be remembered that they play an important role in the aquatic and terrestrial ecosystem (i.e., they are the prey of many terrestrial and a few aquatic species). It is known that the redside shiner and speckled dace are more tolerant of poor quality water than salmonid species and can often be found in the mainstem of Smith River and other tributaries whose temperatures are higher during the summer months. Habitat surveys conducted in 1956 and again in 1971 showed a change in the distribution of shiners and dace (Table 26).

Table 26. Fish species present in the Smith River basin creeks in 1956 and 1971 (data taken from habitat surveys).

Creek Name	1956 CO[1]	1956 STH[1]	1956 CTT[1]	1956 SHI[1]	1956 DAC[1]	1971 CO	1971 STH	1971 CTT	1971 SHI	1971 DAC
Halfway	X	X	X			X	X	X	X	
Clabber	X	X	X							
Upper Johnson		X	X			X	X	X		
Cleghorn	X	X	X							
Hardenbrook		X	X			X				
Yellow	X	X	X			X	X	X	X	X
Deer		X	X					X		
Haney/ Pearl	X	X	X			X	X	X	X	X
Panther	X	X	X	X		X	X	X	X	X
Amberson			X			X	X	X		
Salmonberry		X	X			X			X	X
South Fork	X	X	X	X	X	X	X	X	X	X
Elk	X		X			X	X			
Beaver		X	X			X	X	X		
Summit		X	X			X		X		
Redford		X	X			X	X	X		
Peterson		X	X					X	X	
Tip Davis		X	X			X	X	X	X	
Sleezer	X	X	X			X		X		X
Smith River-main	X	X	X							

[1] CO=Coho, STH= steelhead trout, CTT=Cutthroat trout, SHI= Shiners, DAC= Dace

Status--As anadromous salmonids ascend their spawning streams they become reproductively isolated from one another and form locally adapted populations, also referred to as stocks (Thomas 1993:V-7). To qualify as being distinct, a stock must represent an evolutionarily significant unit of that species (Thomas 1993:V-7), which: 1) must be substantially reproductively isolated from other conspecific population units, and 2) must represent an important component in the evolutionary legacy of the species. Of the 175 "at-risk" anadromous fish stocks in Oregon listed in FEMAT (see Table V-C-3 in Thomas 1993) three occur within this WAU and utilize it as a migration corridor to and from other portions of the Smith River watershed (Table 27). The reasons for these stocks becoming "at-risk" are numerous, with many being out of the hands of Federal land managers, and outside the scope of this analysis. These include ocean harvest, hydroelectric dams and water diversions, and hatchery management (USDA and USDI 1994b). Loss and degradation of freshwater habitats, however, are the most frequently cited factors responsible for this decline (Thomas 1993:V-11), and are within the realm of this analysis. As Federal land managers our greatest concern is with timber harvest, and its associated activities, and how this can influence the degradation of freshwater habitats. Tables 28 and 29 show the current population trends of native anadromous and resident fish within the Upper Smith River basin.

Table 27. At-risk anadromous salmonid stocks occurring within the Smith River WAU (from Thomas 1993).

Species (Stock)	Nehlsen et al.	Nickelson et al.
Coho		Depressed
Winter Steelhead		Depressed
Sea-run Cutthroat Trout (Oregon coastal streams)	Moderate Risk of Extinction	

Table 28. Anadromous fish species indigenous to Oregon occurring within the Smith River WAU.	
Species	ODFW Status
Fall Chinook Salmon (Oncorhynchus tshawystcha)	Stable Population
Coho Salmon (O. kisutch)	Documented depressed population/ potential T&E
Winter Steelhead (O. mykiss gairdneri)	Suspected declining population
Sea-run Cutthroat Trout (O. clarki clarki)	Suspected declining population/ potential T&E
Pacific Lamprey (Lampretra tridentata)	Proposed sensitive (statewide)

Table 29. Resident fish species indigenous to Oregon occurring within the Smith River WAU.	
Species	ODFW Status
Resident Coastal Cutthroat Trout (Oncorhynchus clarki)	Suspected declining population
Western Brook Lamprey (Lampetra richardsoni)	
Redside Shiner (Richardsonius balteatus)	
Speckled dace (Rhinicthys osculus)	
Coast Range Sculpin (Cottus aleuticus)	
Prickly Sculpin (C. asper)	
Riffle Sculpin (C. gulosus)	
Reticulate Sculpin (C. perplexus)	

Because of concern over the rapid decrease in numbers of anadromous salmonids across their entire Pacific Northwest range, numerous groups have submitted petitions to list several of these species under the Endangered Species Act. These listings include: 1) coho salmon petitioned for listing by Oregon Trout and the Pacific Rivers Council in August, 1993 across their entire range in Washington, Oregon and California; 2) steelhead trout petitioned for listing by the Oregon Natural Resources Council in February, 1994 across their entire range in Washington, Oregon, Idaho, and California under a variety of alternatives; and 3) Umpqua Basin sea-run coastal cutthroat trout petitioned for listing by the Oregon Natural Resources Council in April of 1993. A decision by National Marine Fisheries Service (NMFS) proposing the listing of the cutthroat trout is currently awaiting implementation and will, no doubt, affect land management opportunities in the future.

It is critical to realize that all of these fish species (petitioned or not) at various stages in their life cycles will utilize the streams in this WAU either at different times of the year for varying lengths of time (Figures 22 and 23), or only under certain environmental conditions, which can make for a challenging exercise in determination of fish-bearing streams (especially during the summer months). In addition, this also results in the potential of having numerous species during different life stages affected by the same set of external physical variables, impacts, or actions regardless of their origin. These can vary in timing and duration, but could potentially impact generations of fish.

Aquatic Habitat--There is no current data about the overall condition of many of the streams in this analysis area. Habitat inventories were, however, completed on the South Fork of Smith River in 1993. Complete summaries of these habitat inventories can be found in Appendix 3. It is highly recommended that aquatic habitat inventories be completed on the remaining streams within the watershed to fill this critical data gap. With regards to this topic, it should be noted that at the present time, there is a basin-wide effort between federal, state and private (primarily timber industry) landowners in collecting stream habitat data for all streams within the Umpqua Basin (which includes all streams within this analysis area).

As a primary means of comparing past information on stream habitat condition, data from 1956 and 1971 stream habitat surveys are used (Table 30). It should be noted that only 44% of the 1956 miles were surveyed in 1971 and it is not know exactly what criteria were used to base the "good" and "non-spawning" ratings on.

Table 30. Miles of stream with spawnable and non-spawnable salmonid habitats for the years 1956 and 1971 in Upper Smith River.

	1956			1971		
Creek Name	Good (Miles)	Non (Miles)	Total Miles	Good (Miles)	Non (Miles)	Total Miles
Halfway	4.25	6.75	11	2.75	4.5	7.25
Clabber	0.5	3.25	3.75			
Slideout	0	1.5	1.5			
Lower Johnson	0	1.25	1.25			
Upper Johnson	0.25	2.25	2.5	0.1	0.65	0.75
Cleghorn	3.75	7.5	11.25	1.2	2.55	3.75
Hardenbrook	0.25	2.25	2.5	0.45	0.55	1
Yellow	1.25	5.5	6.75	0.75	1	1.75
Deer	0.25	1.25	1.5	0.15	0.35	0.5
Huckleberry	0	1.25	1.25			
Haney	2.5	6.75	9.25	0.7	2.05	2.75
Pearl				0.75	0.25	1
Panther	1.75	10.75	12.5	0.3	3.07	3.37
Amberson	0	1.25	1.25	0.3	0.07	0.37
Salmonberry	0.5	1.75	2.25	0.3	0.7	1
South Fork	7	15	22	0.5	4.75	5.25
Little S.Fork				4.5	0.25	4.75
Nickerson						
Arthur Jones	0	0.5	0.5			
Elk	0.75	2.75	3.5	0.1	1.15	1.25
Beaver	1.25	5	6.25	0.3	0.95	1.25
Cleavenger	0	1	1			
Plank	0	3.75	3.75			
Hefty	0	1	1			
Summit	0.25	3.5	3.75	0.4	0.85	1.25
Redford	0.25	1.75	2	0.1	0.65	0.75
Peterson	0.25	3	3.25	0.1	0.65	0.75
Tip Davis	0	3.5	3.5	0.1	1.4	1.5
Sleezer	0.25	2.5	2.75	0.2	0.8	1
Watering Trough	0	2.5	2.5			
Alder	0	0.75	0.75			
Whiskey	0	0.5	0.5			
Spring						
Smith River-main	1	25.75	26.75	0.25	25.75	26
Total Miles	26.25	126	152.25	14.3	52.94	67.24
Total Percent	17%	83%	100%	21%	79%	100%

Currently, the existing habitat in the mainstem Smith River and lower sections of South Fork Smith are fairly uniform. The streambed substrates are dominated by bedrock, which is characterized by shallow pools, poor pool:riffle ratios, and a low percentage of gravel. In general, the lower reaches of most 4th order and greater streams within the watershed are deficient in instream structure (i.e. large wood). As a result, minimal amounts of spawning and/or rearing habitat for fish exists in these areas. The lack of instream structure is largely due to the road building, salvage logging and stream cleaning that occurred primarily in the 1960's through 70's. Although not in optimum amounts, the mid-to-upper reaches of the these larger streams contain fair to good amounts of spawning and rearing habitat, as do many of smaller tributaries. The primary reasons for their better condition is a combination of : 1) little to no stream cleaning and 2) the existence of beavers throughout many of the smaller drainages. [Confirmed sightings of fresh beaver activity (dams) have been documented on Cleghorn, Amberson, Elk and Summit Creeks and many more are assumed to have these large dam-building mammals.] The beaver dams, which measure up to 4 feet in height and 50 feet in length, create large pool habitats which act much in the same way as log structures do (e.g. retaining bedload and woody debris, providing rearing habitat, maintaining or increasing the water table, etc...). In the lower reaches of the stream (below the dams), deficiencies in large wood are apparent and shallow riffles with bedrock substrate make up the primary habitats. Above the dams, the habitat changes dramatically to gravel-rich riffles and deep scour pools with large amounts of wood. The pools created by the beaver dams also provide excellent habitat for many aquatic species. In general, habitats in and above beaver dams tend to be more diverse and offer better quality habitats for fish, amphibians and aquatic invertebrates. It is important that beavers remain in these systems as they play an important role in the maintenance of many aquatic habitats.

There are three lakes within the analysis area that play an important role in the life history of native fishes in the drainage. The lakes are located on Yellow Lake Creek and Pearl Creek. The total acreage of each is as follows:

Yellow Lake Creek	1.5 acres
Pearl Creek	1.0 acres

Lakes within the Smith River basin are rare but provide excellent rearing opportunities for juvenile salmonids. Provided that the lake remains stratified during the summer months and that ample food is available, young salmonids rearing in the lakes can attain a larger size over their stream dwelling counterparts. The larger size gives them an advantage when embarking on the migration out to sea by increasing their chances for ocean survival and subsequent return as adult spawners. It is therefore necessary to provide as much protection to these lakes through proper land management as possible (i.e. upstream from the lakes as well as directly adjacent to them). Additional sampling should also occur in order to determine rearing potential of the lakes. Sampling could include fish populations, water quality and macroinvertebrate production.

Watershed Restoration

Instream Habitat Enhancement

Several instream enhancement projects have occurred in the analysis area (Table 31). Stream cleaning activities were fairly extensive throughout the region and while adult fish could pass easily upstream, spawning habitat was altered and rearing habitat was removed. In order to recreate some of the former habitat, gabions were placed in the mainstem Smith River and in Cleghorn Creek. The benefits from these projects are multi-fold. In general, through pool development, they assist the agradation of the streambed through gravel retention, prolong the storage of near surface groundwater and begin the development of a more complex and diverse stream system until the natural recruitment of woody debris can be reestablished. Consequently, these structures provide habitat for fish, amphibians and many species of invertebrates. They also serve to reconnect the stream channel with the floodplain and begin the process of returning the stream ecosystem to proper functioning condition. Currently, most of the streams remain downcut and are not functioning properly , therefore interaction with the floodplain occurs only during larger flood events. The total treatment area covered in the analysis area is approximately 1.6 stream miles and includes 72 gabion structures. Five logs were also placed on Cleghorn Creek in 1991. These structures were designed to create additional habitat and to provide better passage through a tributary culvert. Improved access to an additional 2 miles of was created.

Table 31. Fisheries enhancement projects completed in the Smith WAU.				
Stream Name- Date	Legal Location	Project Type	Work Involved	Area Treated or Opened Up for Use
Smith River at Gunter Campground- 1987	T21S/R06W/Sec.01/SE	Habitat development	Placed 41 gabions	0.6 mile of spawning/rearing habitat created
Cleghorn Creek- 1991	T21S/R07W/Sec.03/SW	Habitat development/ Passage improvement	Placed 5 log weirs	Improved access to 2 miles of spawning/rearing habitat
Cleghorn Creek- 1988	T21S/R07W/Sec.03/SW	Habitat development	Placed 31 gabions	1.0 miles of spawning/rearing habitat created

Riparian Silviculture--Riparian silviculture treatments were conducted in 1994 (Table 32). These projects were designed to convert alder-dominated riparian areas to a mixed conifer/hardwood stand. The benefits of the projects include providing for long-term wildlife habitat, large woody debris recruitment, and watershed health (stream bank stability, sediment control, etc...). Site preparation included partial removal or girdling of the red alder dominated canopy and the brushing of shrub species (salmonberry). The planting of conifer seedlings (Western redcedar and Western hemlock and Douglas-fir) occurred after site preparation was completed. The project treats approximately 97.3 acres throughout the Upper Smith River drainage.

Table 32. Riparian enhancement projects completed within the Smith River WAU.		
Stream Name	Legal Location	Acres Treated
Upper Johnson Creek	T21S/R07W/Sec.8	2.8
Cleghorn Creek	T21S/R07W/Sec.3,4,10	27.8
Mainstem Smith River	T20S/R07W/Sec.33 T21S/R07W/Sec.4,5	0.7 4.3
Yellow Lake Creek	T20S/R07W/Sec.20,29	20.9
Salmonberry Creek	T20S/R07W/Sec.25	16.9
Little South Fork Smith River	T21S/R07W/Sec.1	4.8
Nickerson Creek	T21S/R06W/Sec.9	10.7
South Fork Smith River	T21S/R06W/Sec.15, 16,23	8.4

Upland Restoration- Culverts/Roads--The primary human-caused barriers for adult and juvenile fish passage in this WAU are culverts. The effects of these range from delayed to complete obstruction of upstream migration. Complete inventories of all culverts in the watershed have not been conducted, however, several of the larger tributary culverts were reviewed for potential replacement (Table 33). In 1994, a large culvert was placed under Smith River Road at its intersection with Yellow Creek. This culvert will allow for juvenile and adult fish passage and is appropriately sized to withstand a 100 year flood event.

Table 33. Culverts within the Smith River WAU that may pose barriers to fish or could not pass a 100 year flood event.

Creek Name	Juvenile Fish Passage	Adult Fish Passage	Undersized
Clabber	No	Yes	Yes
Slideout	No	No	
Upper Johnson	No	Yes	Yes
Hardenbrook	Yes	Yes	Yes
Deer	No	Yes	
Salmonberry	Yes	Yes	Yes
Little S.Fork (-1.2 junction)	No	Yes	Yes
Nickerson	No	No	Yes
S. Fork (-15.1 junction)	No	No	Yes
S. Fork (-15.0 junction)	No	No	
S. Fork (-22.0 junction)	No	No	

No restoration of roads has yet occurred within the analysis area, however, Transportation Management Objectives (TMO's) have been completed and have identified many roads that could be upgraded or closed to prevent mass wasting or sediment runoff. Many of the identified roads are currently overgrown with vegetation and are in a stable condition. Additional field inspection should be completed to determine if removal of culverts and/or fill is required.

V. MANAGEMENT RECOMMENDATION

Management in the Smith River WAU should proceed on a number of different fronts: old-growth development in the LSRs and Riparian Reserve, riparian restoration/hardwood conversion, stream restoration, and production of forest commodities in the matrix.

LSR Management

Silvicultural treatments within the LSRs should focus on, but are not limited to, "stands that have been regenerated following timber harvest or stands that have been thinned." Possible treatments include: 1) density management to produce large trees, release advanced regeneration, hardwoods, or other plants; or reduce risk from fire, insects, diseases, or other environmental variables; 2) underplanting, and limiting understory vegetation control to begin development of multistory stands; 3) snag and coarse woody debris creation; 4) reforestation; and 5) use of prescribed fire.

Riparian Management

Management of conifer dominated riparian reserves would be accomplished using techniques quite similar to those discussed above. Stands less than 80 years of age would be considered for density management type entries.

Additionally, some riparian stands have become dominated by red alder. In most cases these stands are a result of human influence on the landscape -- most notably timber harvesting. These stands have the potential to be converted from hardwood to conifer dominance. In converting these stands, emphasis would be on releasing established conifer regeneration and in establishing new conifer seedlings. Again, long term management would be aimed at developing late successional/old-growth forest characteristics: large diameter trees, multiple canopies, multiple age classes, large snags and coarse woody debris, and presence of decay and defect in the stand. There are currently 1655 acres of riparian area forested with hardwood dominated, closed canopy stands (Table 23) that may benefit from this or a similar treatment.

Hydrologic/Fisheries Management

The Upper Smith River watershed has the potential for producing large numbers of coho, steelhead and cutthroat trout, provided that the habitat improves over time. A new technique is currently being developed in which whole conifer trees are being pulled over into a creek or stream using a truck mounted cable yarding system. The underlying concept to "tree lining" is the mimicking of a tree naturally falling into the riparian and stream system. Whole trees, with rootwads attached, are more apt to stay in the stream system over the long term, provide a more natural functioning structure, and require no cabling to the stream substrate (as do cut logs and gabion structures). The Upper Smith River, especially the mainstem, has a high potential for this restoration technique. Ideally, streams with gradients of less than 3% and that have large numbers and sizes of conifer trees in riparian areas are optimum candidates for this type of project. In reviewing the slope class map, it is evident that the majority of the mainstem is within the 3% range. There are also several areas along the mainstem where there are large surplus conifers. An interdisciplinary team would have to review the project prior to commencement so as to take into consideration the needs of riparian dependent and large wood dependent terrestrial species. Other potential tree lining streams include: Yellow Lake Creek, Haney Creek, Panther Creek, Little South Fork and the mainstem South Fork.

Discussions of the watershed functions discussed in chapter II and the major issues discussed in chapter III yielded some specific management recommendations. These recommendations have been grouped below:

- Correct the identified mapping errors, and reconfigure subbasin delineations to accurately identify distinct hydrologic units; examples of reconfiguration would be separating subbasins that currently represent more than one 3rd order stream; the delineation of lower, middle, and upper Frontals of the mainstem Smith River. Perform a more precise hydrologic analysis of the reconfigured subbasins.

- Schedule forest management activities, specifically regeneration timber harvest, so that all subbasins have less than 15% Equivalent Clearcut Area (defined by the parameter of stand age less than or equal to five years); allow all subbasins that have ECA greater than 15% to recover sufficiently. Private land within the subbasins will need to be included in the evaluation of ECA. At this time, the following subbasins are suggested to assess for regeneration harvest activities: Tip Davis, Summit, Peterson, Plank.

- The one percent of roads available for decommissioning should be assessed and implemented if found to be feasible. Since road closure is not possible on a large scale, all subbasins should have road renovation and culvert replacement projects planned, with priority given to: subbasins with over-average road densities and percentages of roads to streams; old roads that have moderate to high amounts of use. Specific projects should include increasing the number of ditch-relief culverts, and replacing (if needed) all stream crossing culverts to accommodate 100 year flood events.

- Conduct basin-wide instream habitat surveys on all major fish bearing streams every five to seven years; use the data collected to identify restoration activities.

- Conduct basin-wide road system surveys to determine: the condition of roadbeds, ditch-relief culverts and stream crossing culverts; the location and stability of sidecast and waste areas; use the data collected to identify restoration activities; conduct surveys year round, but particularly during storm events in the fall, winter, and spring.

- Implement a comprehensive stream flow and sediment yield monitoring program throughout the basin; use the data collected to study basin recovery trends, and identify streams that have unusually high or low attributes.

- Table 33 identifies specific culvert locations that may pose a fish passage problem or flooding hazard and may require modification or replacement.

Intensive Forest Management

Regeneration harvest and forest management aimed at developing commercially harvestable stands will occur on Matrix lands. Standards and guidelines specific to matrix lands are listed on page C-39 of USDA and USDI (1994). Commercially oriented, forest management may include the following components: commercial harvest using aerial, cable, and/or ground based systems; slash treatments, such as burning or piling; planting a species mix of genetically superior seedlings, suppression of competing vegetation; precommercial thinning, commercial thinning; fertilization, and fire suppression.

Forest Management

Approximately 8800 acres or BLM land, in all land use allocations, is currently available for commercial thinning or regeneration harvest. Table 34 represents acreage available for commercial thinning and regeneration harvest by land use allocation, as described in the Roseburg PRMP.

Table 34. Acres available for commercial thinning and regeneration harvest[1].

Land Use Allocation	Commercial Thinning Acres	Regeneration Harvest Acres
GFMA	1667	2444
Connectivity	343	436
LSR2	642	N/A
LSR1	3176	N/A
TOTAL	5828	2880

[1] Acreage does represent influence of riparian reserves as described by USDA and USDI (1994).

Table 35. Fertilization in the Smith River WAU.			
	GFMA (acres)	Connectivity (acres)	LSR (acres)
Completed[1]	1443	316	963
Needs[2]	758	-0-	615
Total Ac	2401	316	1578

[1] Completed = Most units are 1960 or later, but some date back farther.

[2] Needs = Units that have been PCTed but not fertilized.

Wildlife

Prior to initiation of any proposed actions that may be a ground disturbing activity or one that is extremely noisy, within a quarter of a mile of suitable marbled murrelet habitat, we need to either seasonally restrict (i.e. those actions that are too noisy) or survey all potential murrelet habitat to protocol standards and determine the level of avian activity at the site(s) ---- absence/detections observed/occupied (see protocol and definitions developed by Ralph et al. 1993).

Roads

The following roads were identified from the aerial photographs as possible problem areas. An on the ground survey is needed for a more complete listing and to verify selections.

Halfway Creek subbasin:

1. BLM rocked road 21-7-19.2 (possible cutslope problems)
2. BLM unsurfaced road in the SE¼NE¼ Sec. 12, T. 21 S., R. 8 W. (possible surface problems)

Johnson Creek subbasin: BLM unsurfaced road 21-7-7.2 (possible surface problems)

Hard Slides:

1. BLM rocked roads 20-7-32.1 and 20-7-30.0 (possible cutslope problems).

2. BLM unsurfaced roads 21-7-5.3 and 21-7-4.4 (possible surface problems)

Yellow-Deer subbasin:

1. BLM rocked road 20-7-33.1 (rills channeling water down roadbed: field observation)

2. upper part of the BLM rocked road 20-7-32.0 (possible cutslope problems)

3. BLM rocked road 20-7-28.0 (rock in poor shape; rock absent along one stretch: field observation)

Paradise (Little South Fork) subbasin:

1. BLM unsurfaced 21-7-1.4 road (possible surface problems)

2. BLM road 21-7-1.0 where it is unsurfaced in the NE¼NW¼ of Sec. 13, T. 21 S., R. 7 W. (possible surface problems)

3. BLM rocked road 21-7-1.2 in the NW¼ Sec. 1, T. 21 S., R. 7 W. (cutslope failures)

4. BLM rocked road 21-6-13.0 road in the SW¼ of Sec. 6, T. 21 S., R. 6 W. (Did large debris avalanche in the mid 1980's adversely affect road? Is mitigation still necessary?)

Panther Creek subbasin:

1. BLM unsurfaced road 20-7-13.0 (possible surface problems)

2. BLM unsurfaced road 20-7-25.1 (possible surface problems)

Amberson Creek subbasin:

1. BLM unsurfaced road 21-7-2.0 (possible surface problems)

2. Private road 20-7-26.1 across BLM surface (possible surface problems. It appears that the road healed over and the road was then reopened for a BLM clearcut).

Salmonberry subbasin: Weyerhaeuser's rocked spur AJ-1 across BLM surface in the N½NE¼ Sec. 31, T. 20 S., R. 6 W., (slide and cutslope ravel filling ditch: field observation)

Elk Creek: BLM rocked road 20-6-32.2 (possible cutslope erosion problems)

Hefty Clevenger: Private unsurfaced road 20-6-35.1 through W½NW¼ Sec. 35, T. 20 S., R. 6 W., on BLM surface (possible surface problems; road opened up for a BLM clearcut)

Summit Creek: BLM unsurfaced road 20-6-35.0 (possible surface problems scattered along road)

Peterson - Sleeze: Private unsurfaced road 21-6-1.3 on BLM in N½NW¼ Sec. 11, T. 21 S., R. 6 W., (possible surface problems)

- Transportation management objectives (TMOs) need to be completed for the watershed. Once these have been complete then additional road segments may be identified for resurfacing, modifictions, closure, or removal.

Monitoring

Monitoring of all activities will continue in compliance with the Forest Plan monitoring requirements, District monitoring plans, and NEPA requirements.

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Figure 1. Land use allocations within the Smith River watershed analysis area.

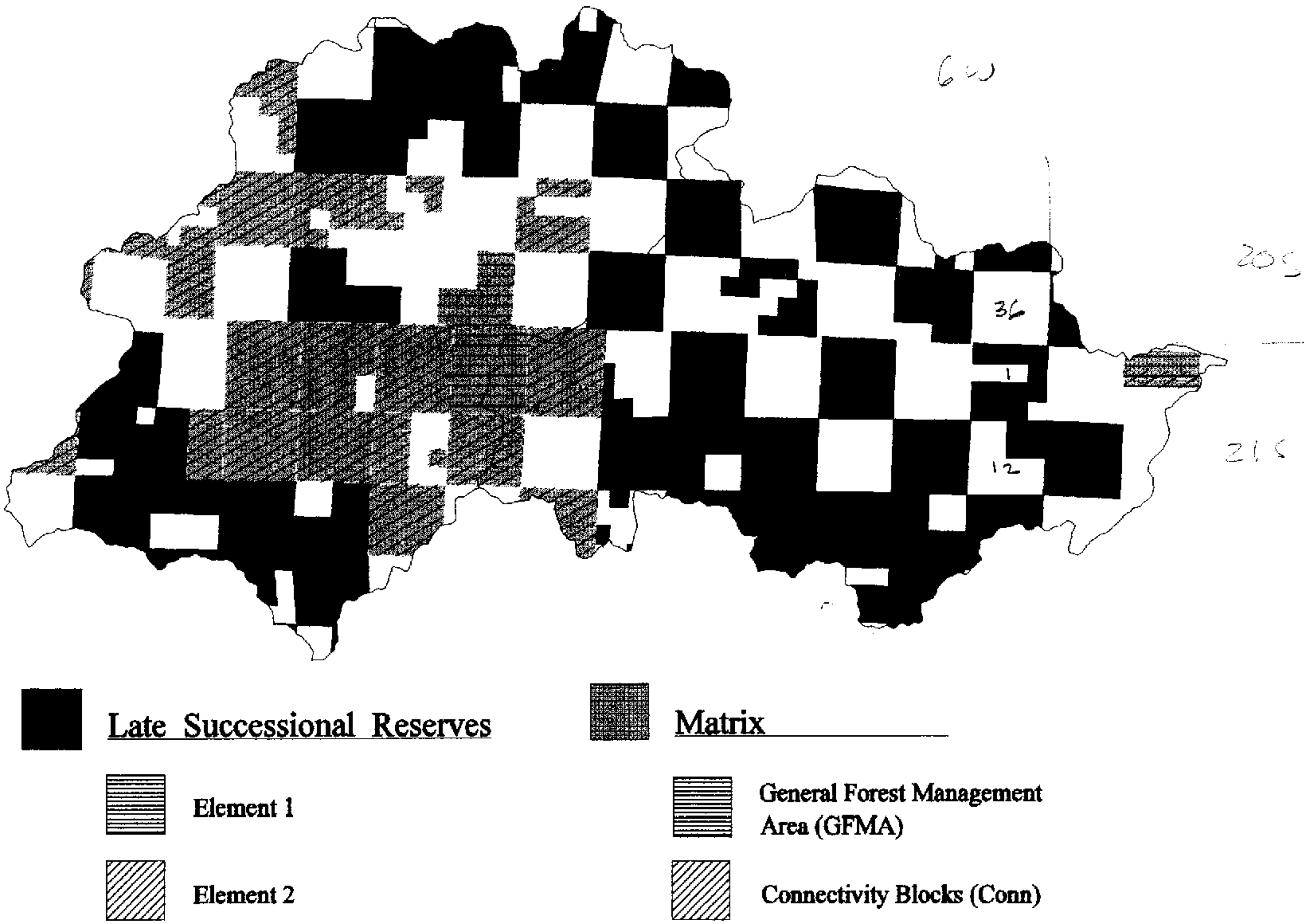


Figure 2. Location of the Smith River watershed analysis area.

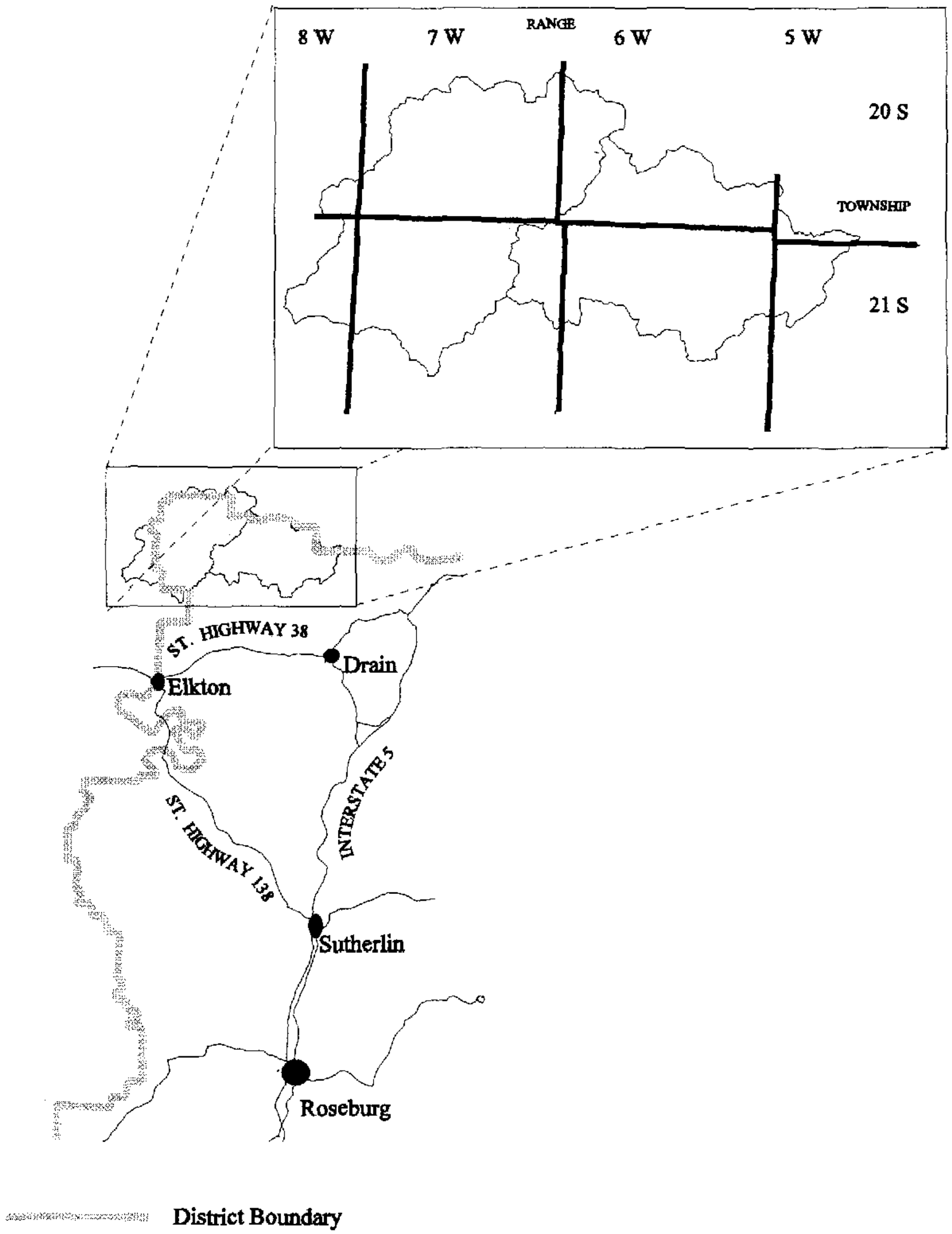
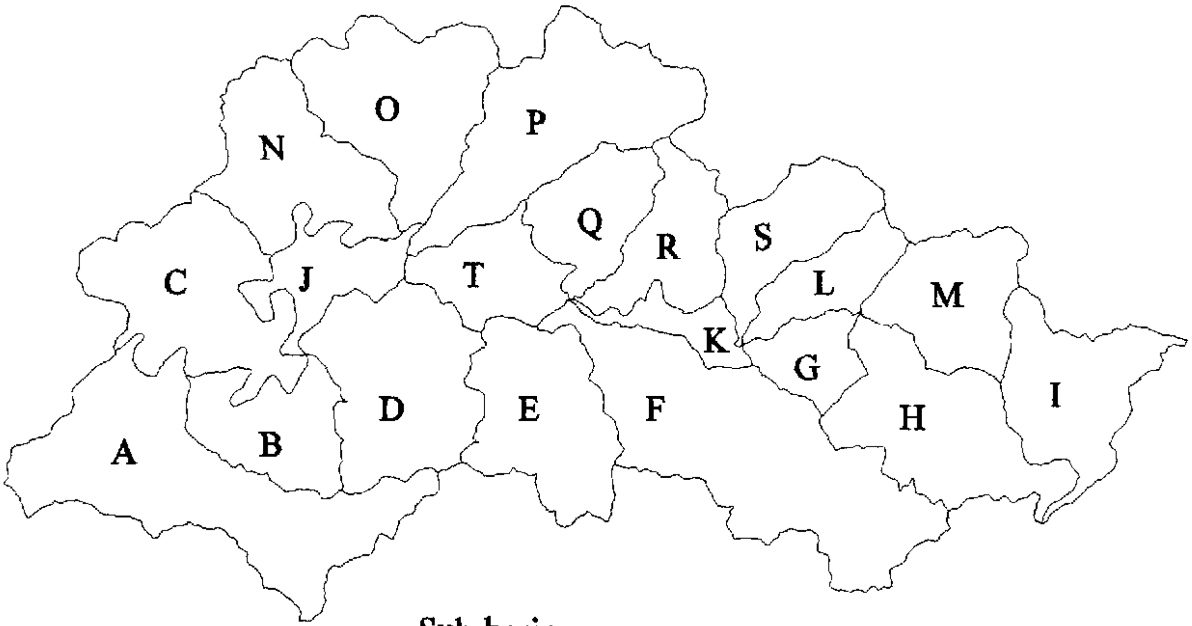


Figure 3. Sub-basins within the Smith River watershed analysis area.



Sub-basin

A Halfway Ck
B Johnson Ck
C Hard Slides
D Cleghorn Ck
E Paradise
F South Fork
G Plank Ck
H Peterson Sleeze
I Tip Davis Spring
J Smith Front
K Smith 80
L Hefty Clevenger
M Summit Ck
N Yellow Deer
O Haney Ck
P Panther Ck
Q Salmonberry
R Elk Ck
S Beaver Ck
T Amberson Ck

Figure 4. 1914 Fire map for the Smith River WAU.

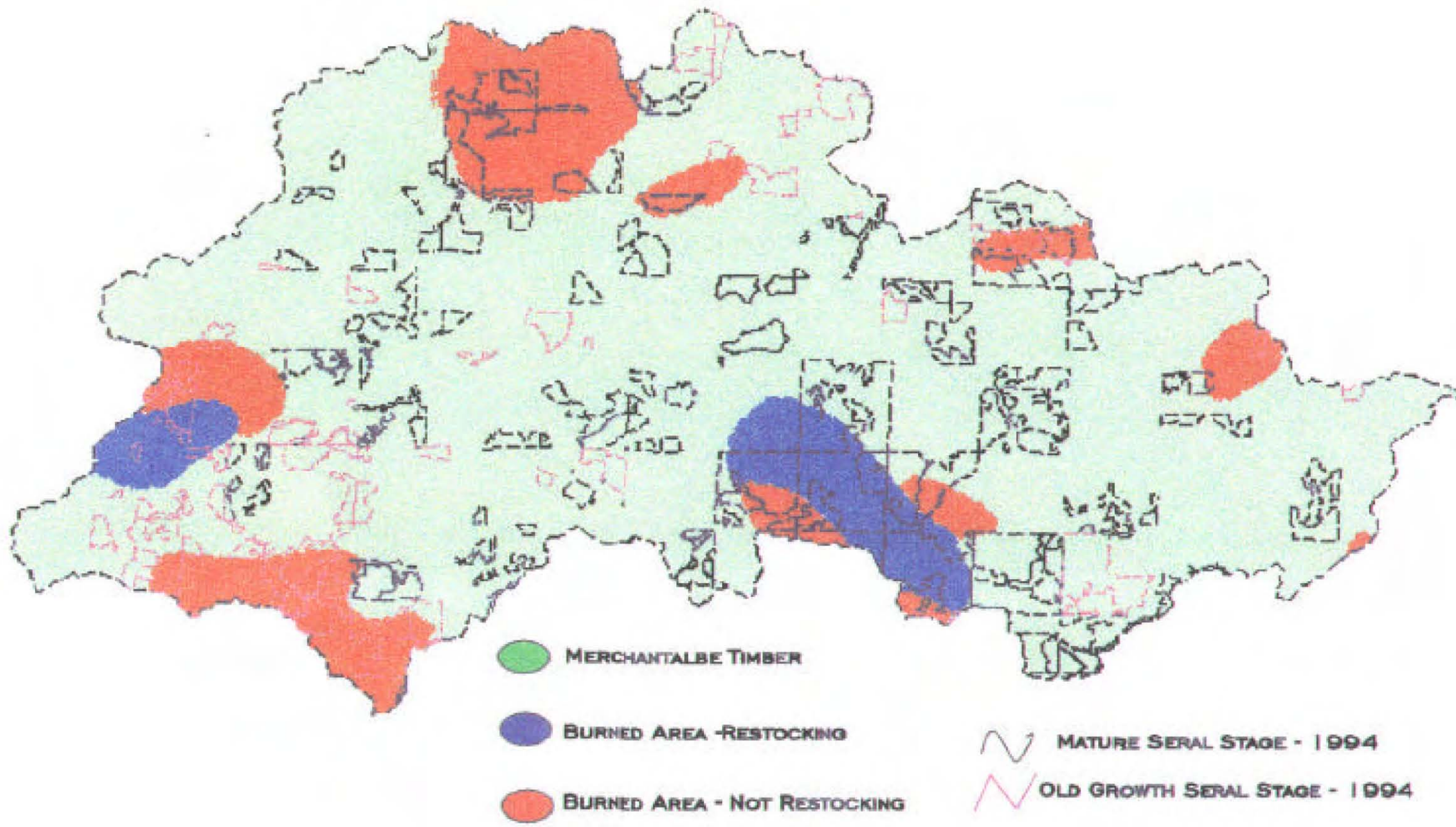


Figure 5. Seral stage distribution in the Smith River WAU.

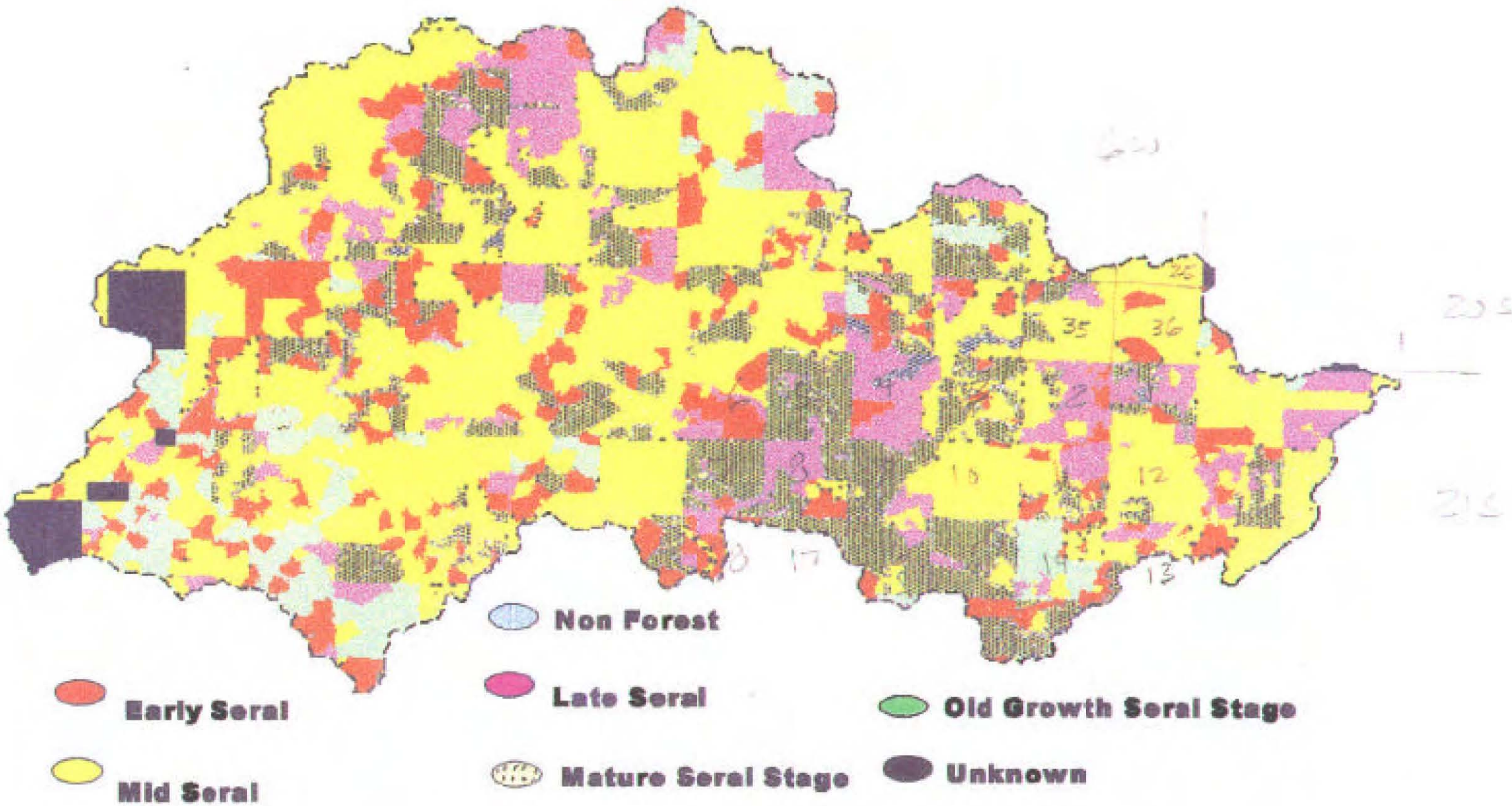


Figure 6. Climatological data for the weather stations nearest to the Smith River WAU.

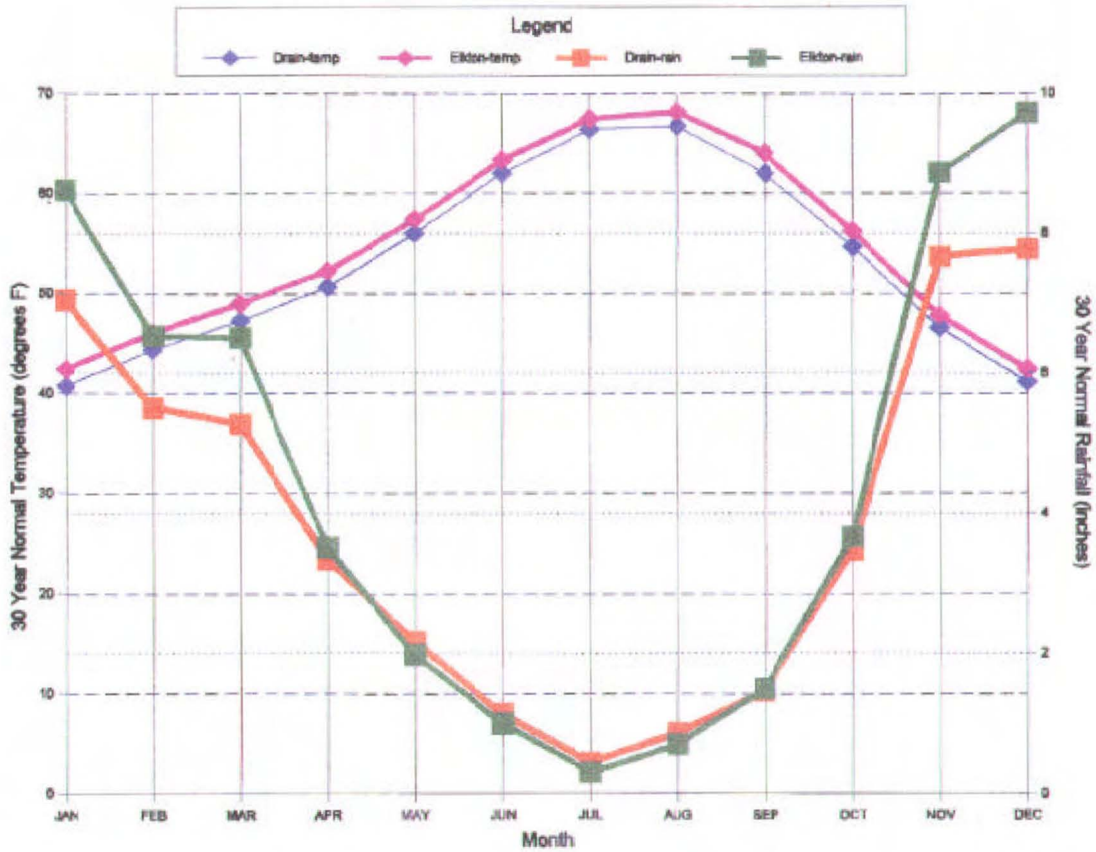
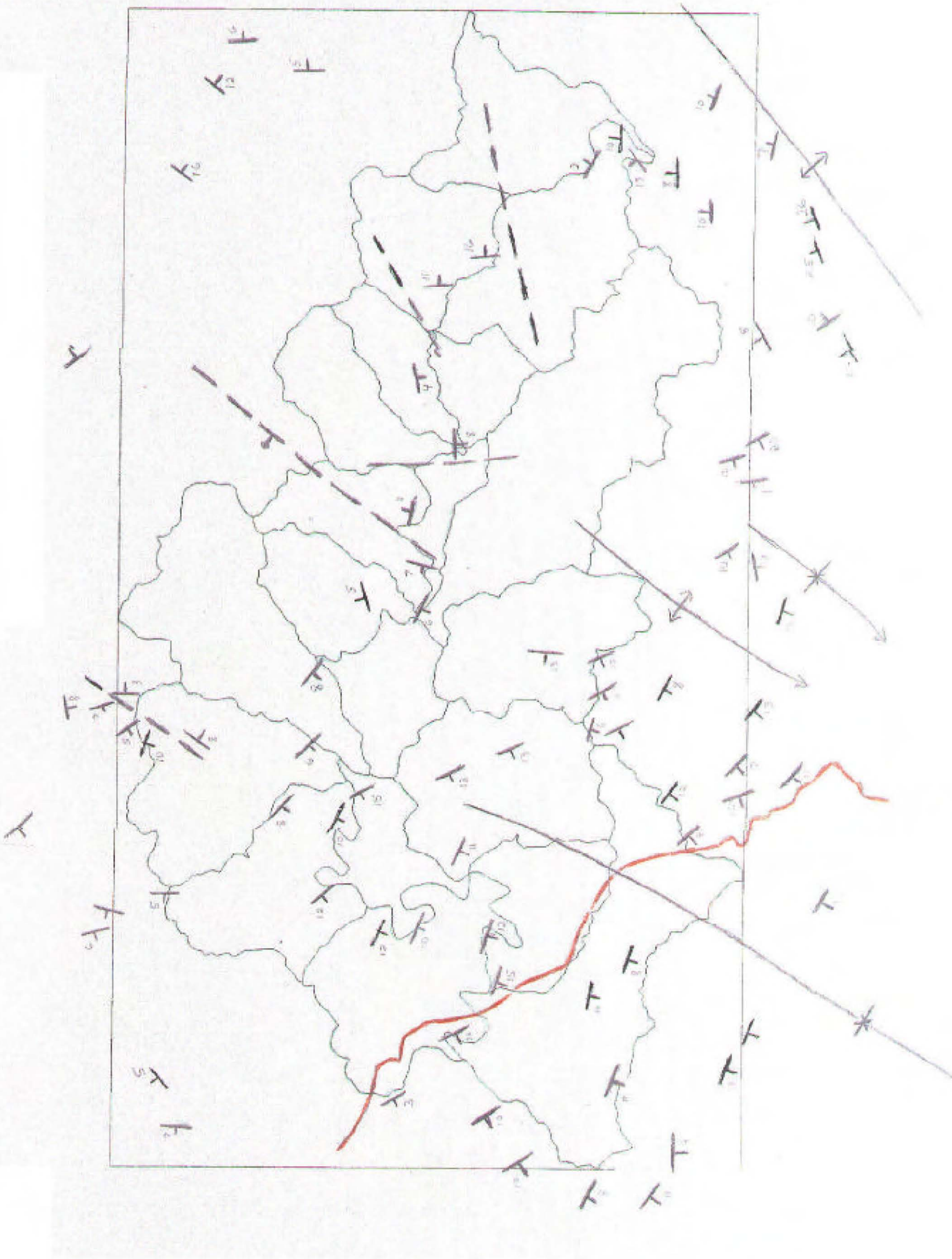


Figure 7

Geology

Legend on following page



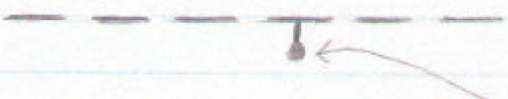
Legend of Geology Map:

The boundary between the undiferentiated Tyee formation to the southwest and the Siuslaw member of the Flournoy formation to the northeast.

strike of an inclined bed

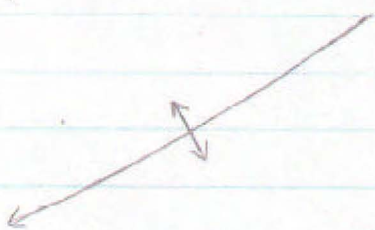
the direction of the maximum dip of the inclined bed. In the example shown the dip is to the southwest.

the angle of the dip in degrees

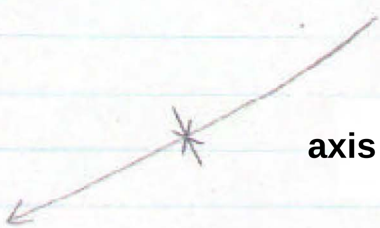


Inferred location of a fault

ball on downthrown block side



axis of an anticline



axis of a syncline

The contents of this map are taken from the Compilation Map of Southern Tyee Basin, Southern Coast Range Oregon by Alan and Wendy Niem, OSU (1990).

SCALE 1: 24000

1.00 0 1.00 MILE

1.00 0 1.00 KILOMETER

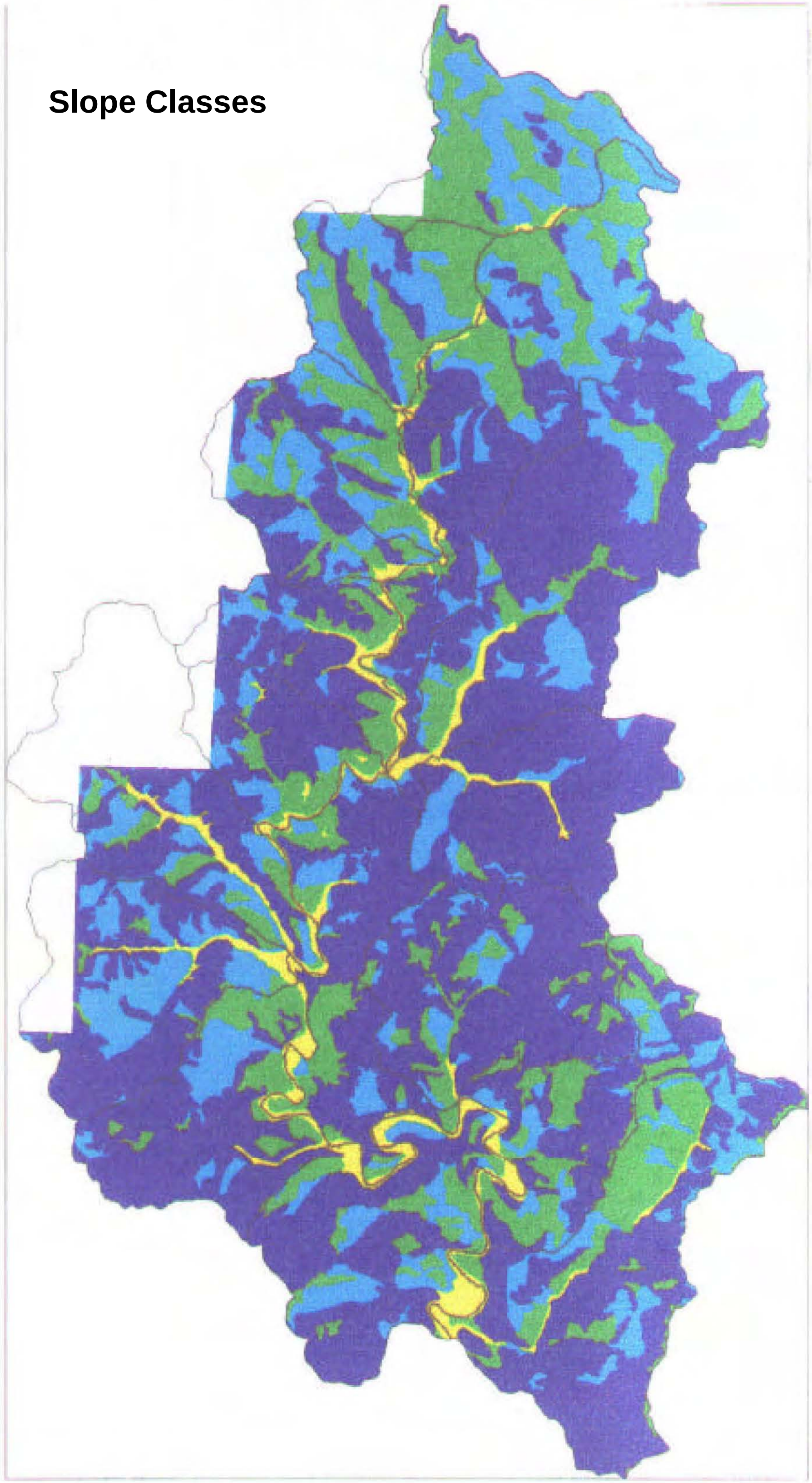
N

SMITHSOILSPARBL
SMITH-BABY ALL

SOIL MAPPING UNITS
SUBBASIN BOUNDARIES

SMITH RIVER LAU SOILS MAP

Figure 9



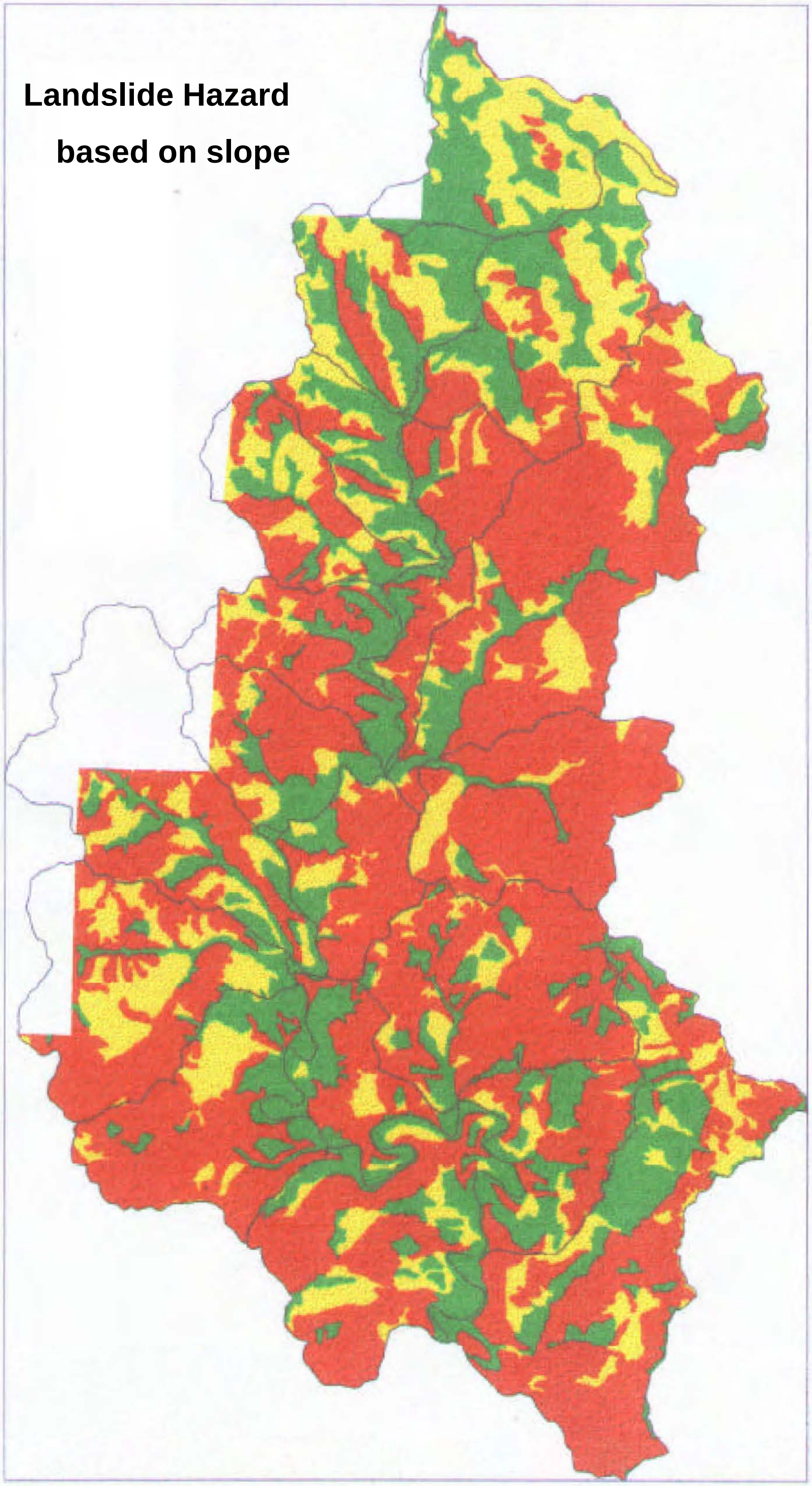
Yellow = 0 to 3% Green = 3 to 30% Light Blue = 30 to 60% Dark Blue = 60 to 90%

Slope Class Distribution

Percent Slope	Area (acres)	Percent of Area	Percent* of Area
0 to 3	2,392	4.8	5.1
3 to 30	9,489	19.2	20.4
30 to 60	11,296	22.9	24.3
60 to 90	23,322	47.3	50.2
No Data (Lane Co.)	2,847	5.8	
Total	49,346	100.0	

* Excluding Lane County (total acres = 46,499)
46,499 acres = 100%

Figure 10



Green: Low Hazard
(0 to 30% slope)

Yellow: Moerate Hazard
(30 to 60% slope)

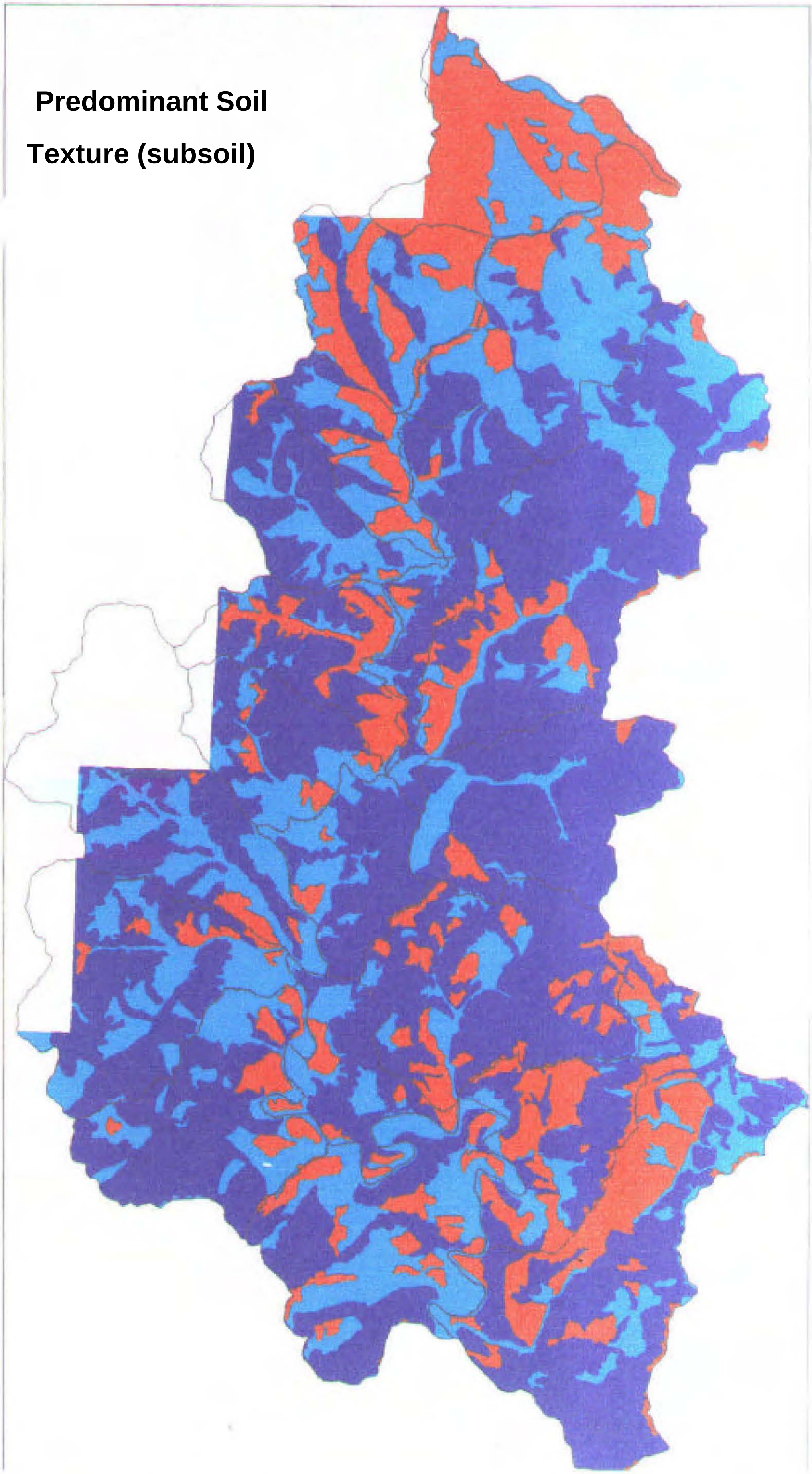
Red: High Hazard
(60 to 90% slope)

Landslide Hazard:

	Area (Acres)	Percent of Area	Percent* of Area
Low (0 to 30% slopes)	11,881	24.0	25.6
Medium (30 to 60% slopes)	11,296	22.9	24.3
High (60 to 90% slopes)	23,322	47.3	50.2
No Data (Lane County)	2,847	5.8	
Total	49,346	100.0	

* Excluding Lane County (total acres = 46,499)
46,499 acres = 100%

Figure 11



Light Blue: **Loamy**

Dark Blue:
Loamy-Skeletal
(high rock fragment content)

Red: Clayey

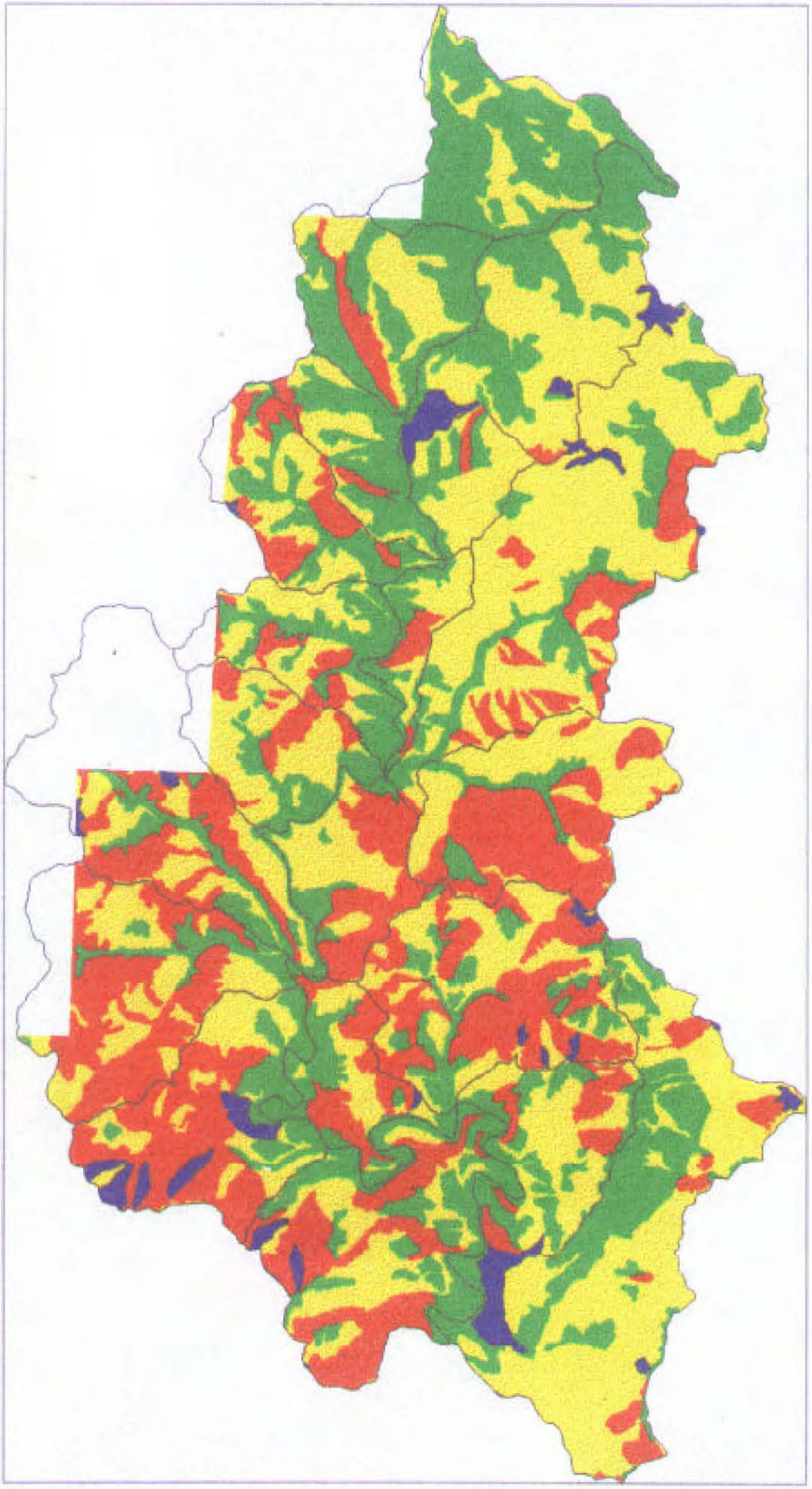
Predominant Soil Texture (subsoil)

Subsoil Texture	Area (Acres)	Percent of Area	Percent* of Area
Loamy	14,556	29.5	31.3
Loamy-Skeletal	23,372	47.3	50.2
Clayey	8,571	17.4	18.4
No Data (Lane Co.)	2,847	5.8	
Total	49,346	100.0	

*Excluding Lane County (total acres = 46,499)
46,499 acres = 100%

Comment: Generally the clayey soils are confined to the gentler slopes and are moderately deep to veery deep. The loamy skeletal soils primarily occur on slopes greater than 30 percent and are primarily shallow and moderately deep in depth.

Figure 12 **Soil Depth to Bedrock**



Blue: moderately deep and shallow soils complexed with rock outcrop (shallowest average depths)

Red: moderately deep -shallow soil complexes (next shallowest average depths)

Yellow: moderately deep and moderately deep - very deep soil complexes (medium average depths)

Green: very deep soil complexes (deepest average depths)

Soil Depth to Bedrock

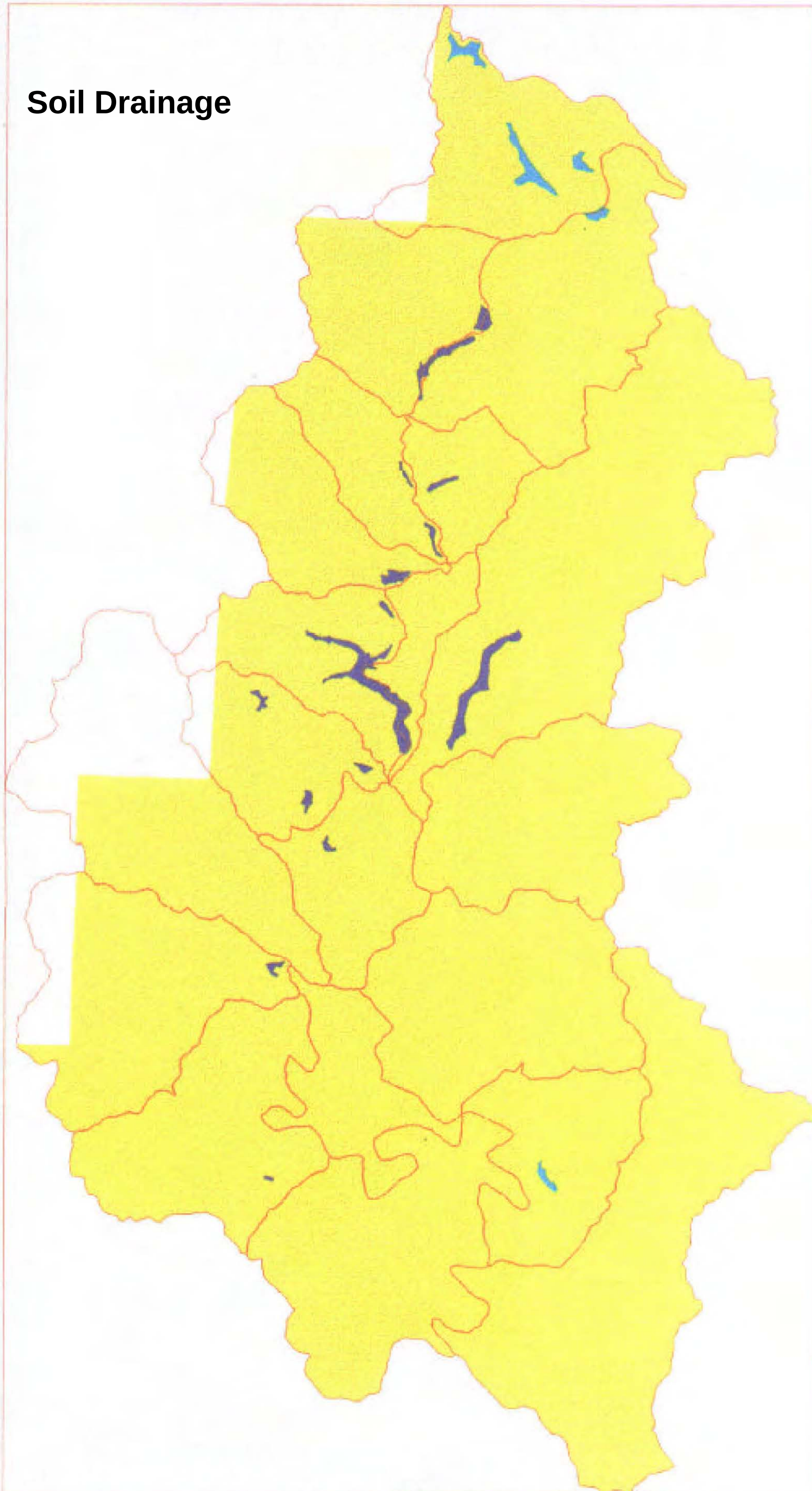
	Area (acres)	Percent* Area
Moderately Deep-Shallow Soils-Rock Outcrop Complexes (Shallowest average depths)	1,006	2.0/2.2
Moderately Deep-Shallow Soils Complexes (shallower average depths)	11,365	23.0/24.4
Moderately Deep Soil Mapping Units and Moderately Deep-Very Deep Soil Complexes (medium average depths)	21,347	43.3/45.9
Very Deep Soil Mapping Units (deepest average depths)	12,781	25.9/27.5
No Data (Lane County)	2,847	
Total	49,346	

* The second figures are percentages based on the acreage of data available (46,499 acres); 46,499 acres = 100%

shallow = 10 to 20 inches to bedrock
moderately deep = 20 to 40 inches to bedrock
deep = 40 to 60 inches to bedrock
very deep = greater than 60 inches to bedrock

Figure 13

Soil Drainage



Yellow: moderately well and well drained

Light Blue: somewhat poorly drained (wet soil)

Dark Blue: poorly drained (wet soil)

Soil Drainage

	Area (acres)	Percent of Area	Percent* of Area
Moderately well and well drained	45,949	93.0	98.8
Somewhat poorly drained	142	0.3	0.3
Poorly drained	408	0.9	0.9
No Data (Lane County)	2,847	5.8	
Total	49,346	100.0	

*excluding Lane County (total acres = 46,499 = 100%)

Comments: Somewhat poorly drained soils have a seasonably high water table near the surface. Poorly drained soils have high water tables at or near the surface for a considerable part of the year.

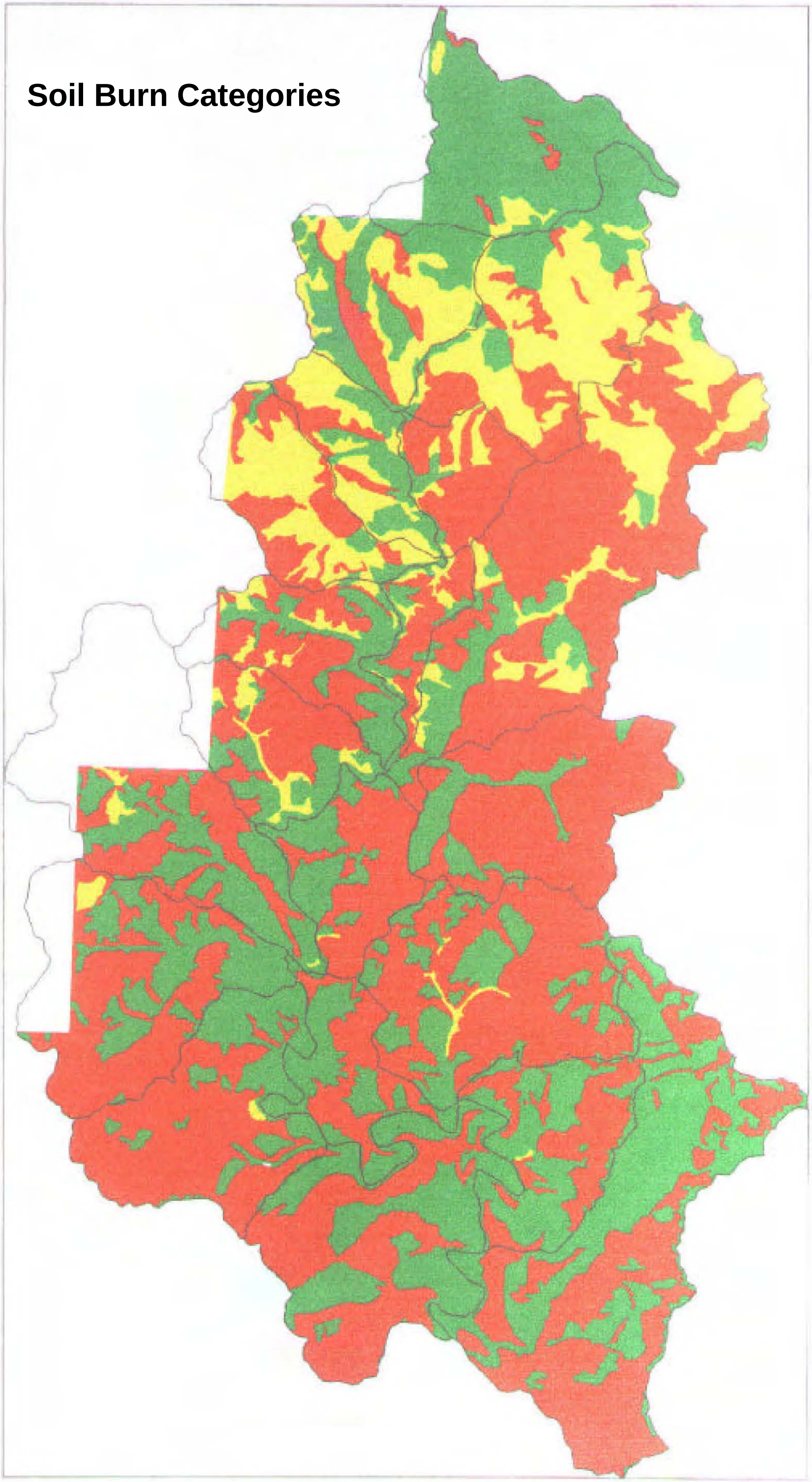


Figure 14

Red: Category 1
(Highly sensitive soils)

Yellow: Category 2
(Moderately sensitive soils)

Green: Category 3
(Least sensitive soils)

Soil Burn Categories

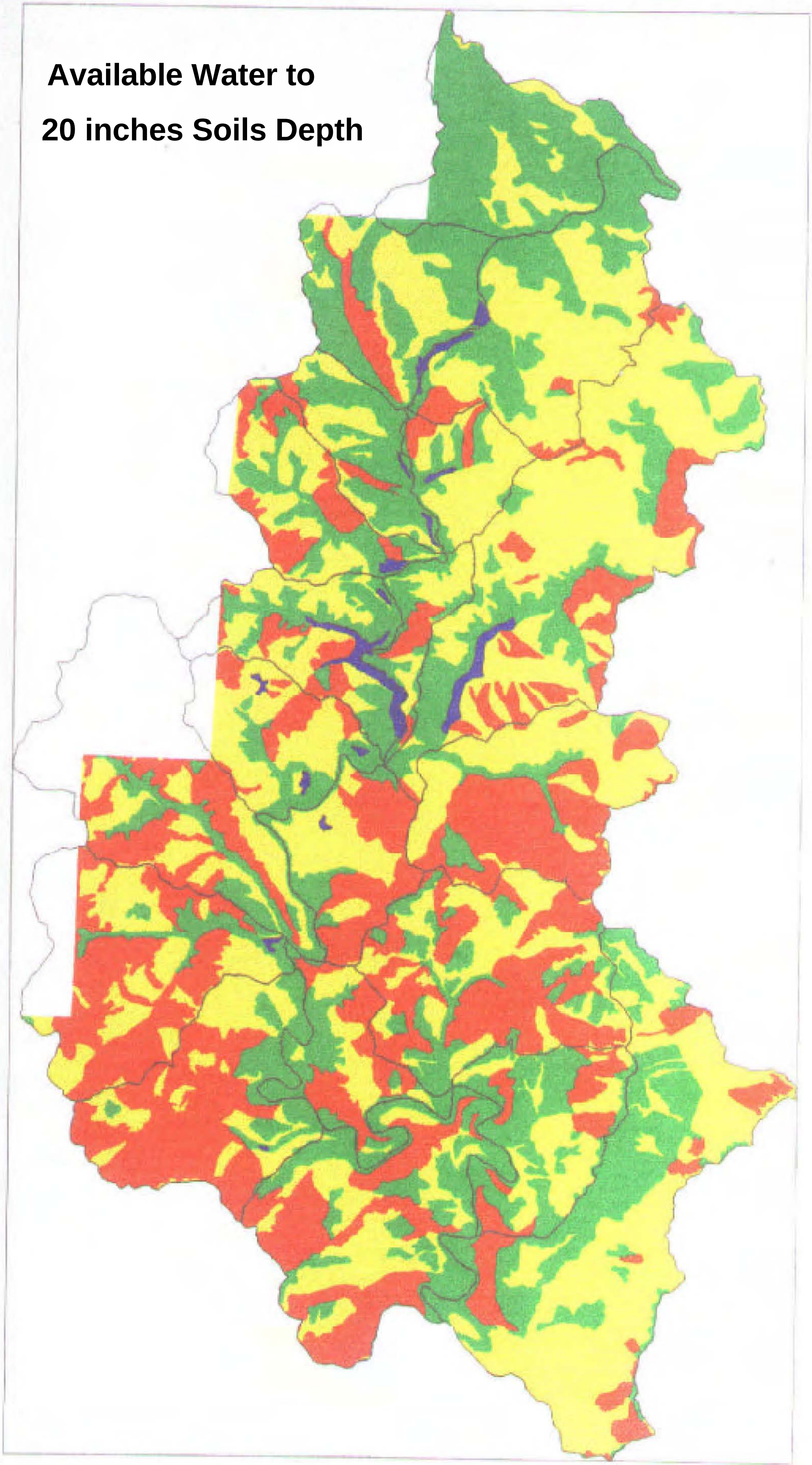
	Area (acres)	Percent of Area	Percent*of Area
Category 1 (highly sensitive soils)	23,849	48.3	51.3
Category 2 (moderately sensitive soils)	6,163	12.5	13.3
Category 3 (least sensitive soils)	9.056	18.4	19.5
No Data (Lane County)	2,847	5.8	
Total	49,346	100.0	

* excluding Lane County (total acres = 46,499 = 100%

Category 1 soils are classified as:

a. all shallow soils (less than 20 inches depth
b. all soils with less than 4 inches of A horizon
c. all soils on slopes which exceed 70 percent

Figure 15



Red: Low (less than 2 inches)

Yellow: Medium (2 to 4 inches)

Green: High (3 to 4 inches)

Blue: Variable due to fluctuating high water tables

Available Water to 20 inches Soil Depth

	Area (acres)	Percent of Area	Percent of Area
Low (less than 2 inches)	12,370	25.1	26.6
Medium (2 to 4 inches)	20,274	41.0	43.6
High (3 to 4 inches)	13,447	27.3	28.9
Variable (soil with high water tables	408	0.8	0.9
No Data (Lane County)	2,847	5.8	
Total	49,346	100.0	

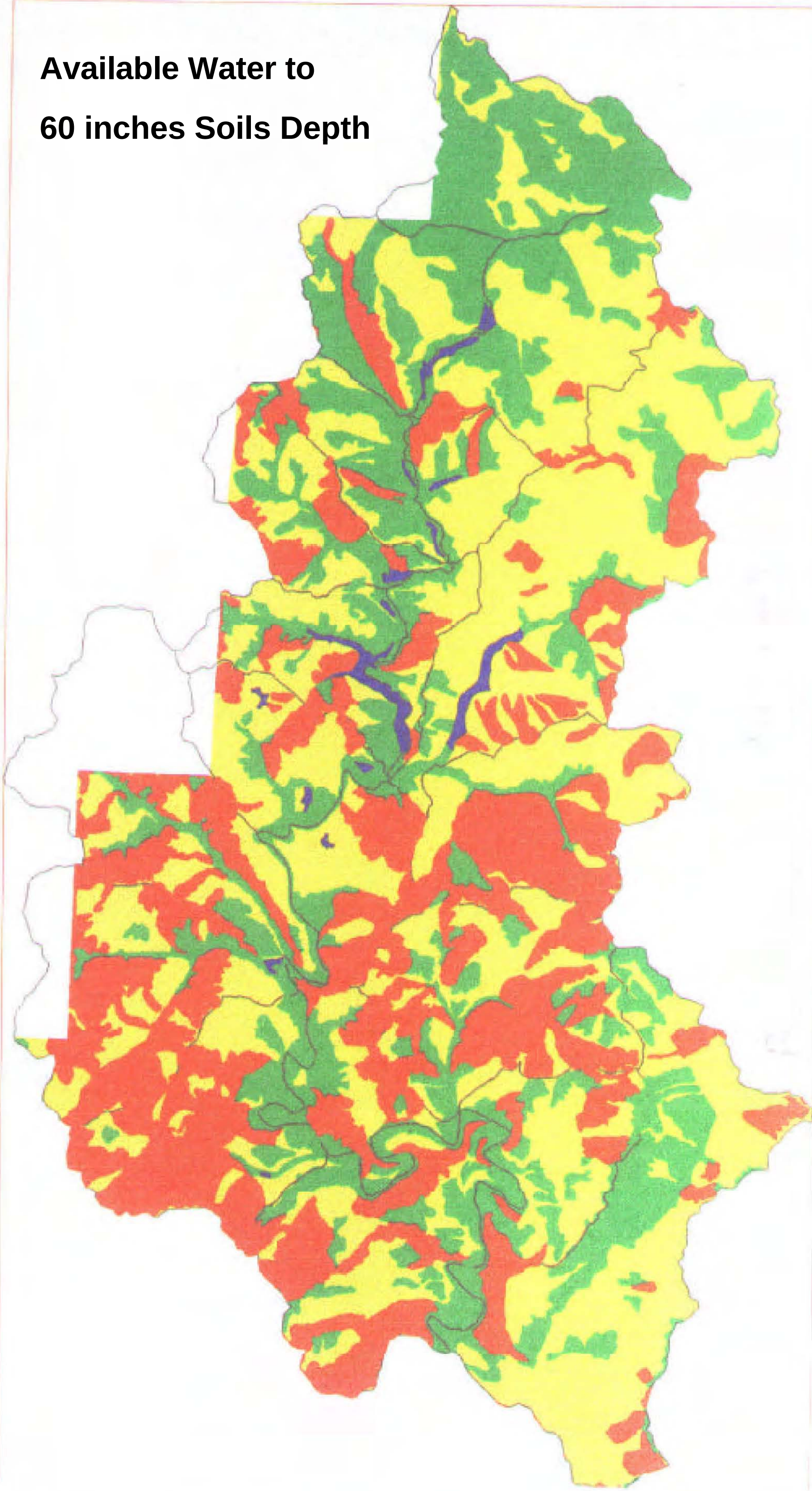
* excluding Lane County (total acres = 46,499 = 100%)

Note: There are overlapping capacities between the medium and high categories due to different combinations of soils within mapping units. One mapping unit may be a complex of a soil with an AW around 2 inches and another soil with an AW above 3 inches. Another mapping unit may have both soils with AW above 3 inches.

Comment: Available water in the top 20 inches has been used to help assess survival capabilities of seedlings in a particular soil.

Available Water to 60 inches Soils Depth

Figure 16



Red: Complexes of very low and low (1.4 to 4.0 inches)

Yellow: Complexes of Lows, Mediums, Highs and Very Highs (3.0 to 11.0 inches)

Green: Complexes of Highs and Very Highs (7.5 to 11.0 inches)

Blue: Variable (due to high water tables)

Available Water to 60 inches Soils Depth

	Area (acres)	Percent of Area	Percent* of Area
Complexes of Very Low and Low (1.4 inches to 4.0 inches)	12,370	25.1	26.6
Complexes of Low, Mediums Highs and Very Highs (3.0 inches to 11.0 inches)	21,347	43.3	45.9
Complexes of Highs and Very Highs (7.5 inches to 11.0 inches)	12,373	25.1	26.6
Variable due to high water tables	408	0.8	0.9
No Data (Lane County)	2,847	5.8	
Total	49,346	100%	

* excluding Lane County (total acres = 46,499 = 100%

Comments: Available water in the top 60 inches is more appropriately used after successful seedling establishment.

Average King 50 Year Site Index for Douglas Fir

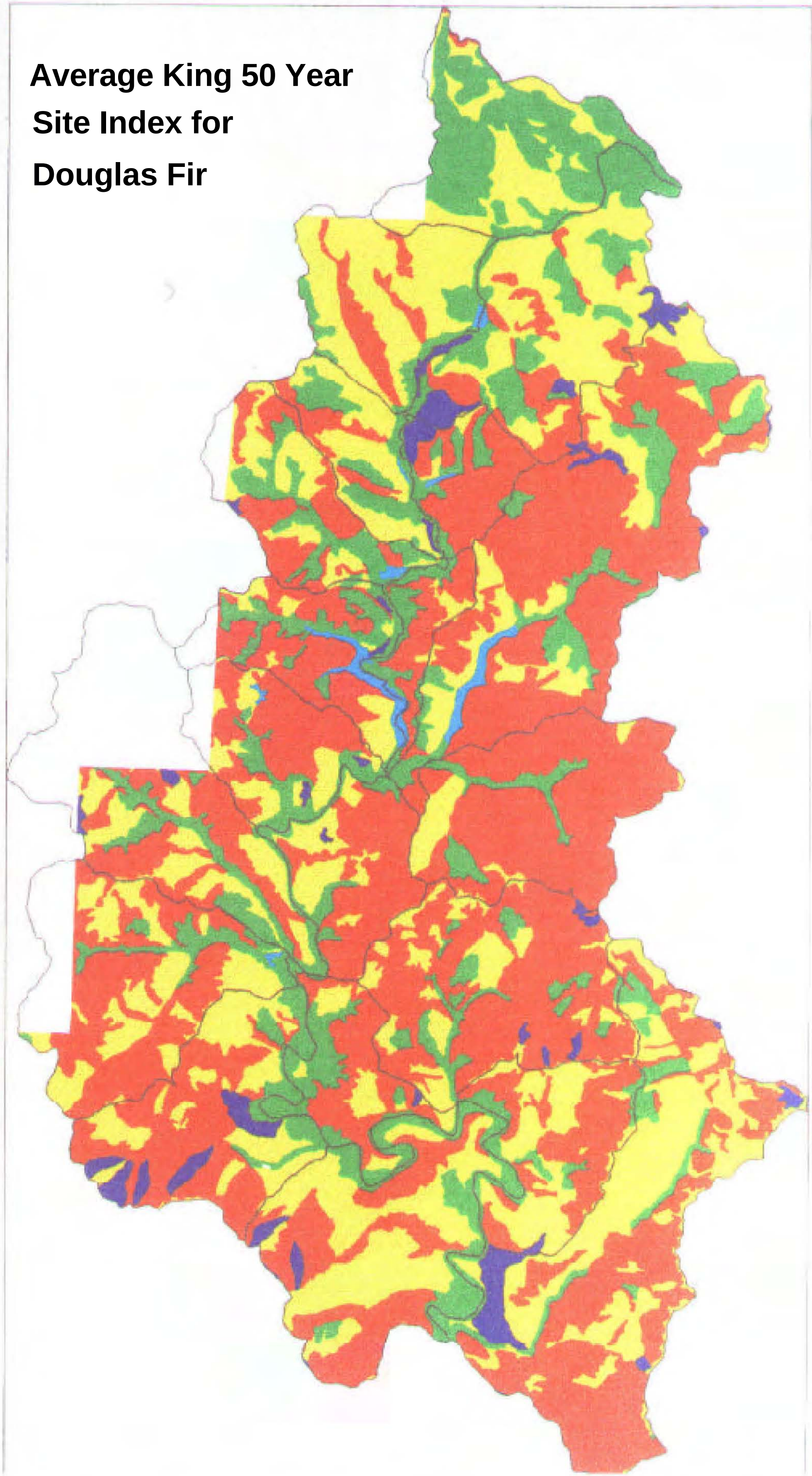


figure 17

Dark Blue: Less than 100

Red: 100 to 110

Yellow: 110 to 120

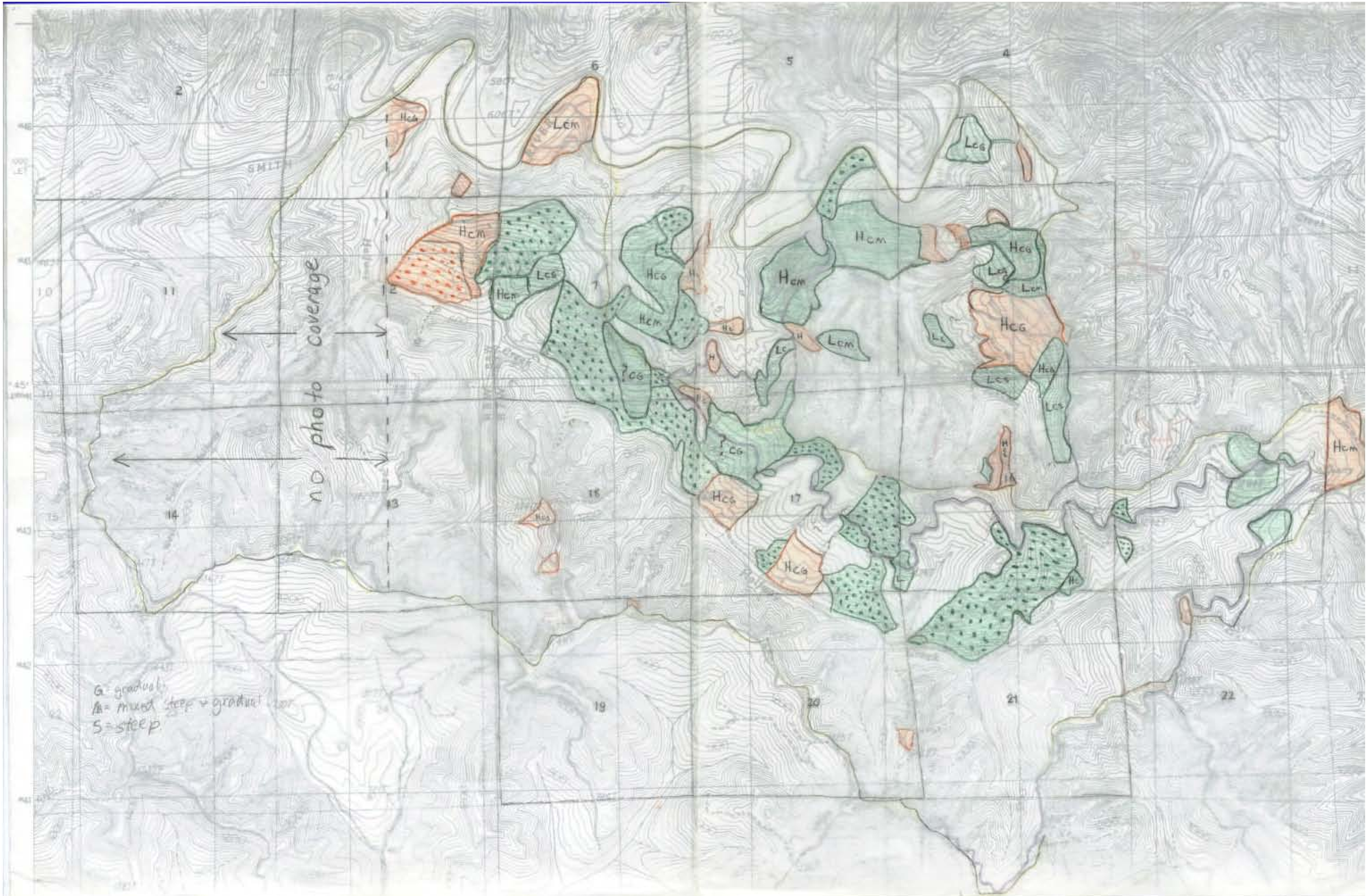
Green: 120 to 140

Light Blue: No site under data

King 50 Year Index for Doug Fir (average)

	Area (acres)	Percent of Area	Percent * of Area
Less than 100	1,099	22.3	23.6
100 to 110	21,805	44.2	46.9
110 to 120	15,206	30.1	32.7
120 to 140	8,070	16.4	17.4
No Site Index Data	316	0.6	0.7
No Data (Lane County)	2,847	5.8	
Total	49,346	100.0	

* excluding Lane County (total acres = 46,499 = 100%

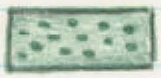


no photo coverage
SMITH
Hcm
Lcm
HcG
LcG
Lcs
Hcs
?cG
G = gradual
M = mixed steep + gradual
S = steep

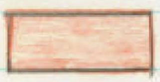
Ground which was cat logged in the Halfway Creek and Johnson Creek subbasins which is discernable from the aerial photo record from 1959 to 7/1994.

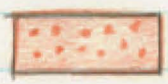
Cat Logging prior to 8/1970

 clearcut operations

 salvage type operations in mature and old growth forest where skid trail density is quite high.

Cat Logging after 8/1970

 clearcut operations

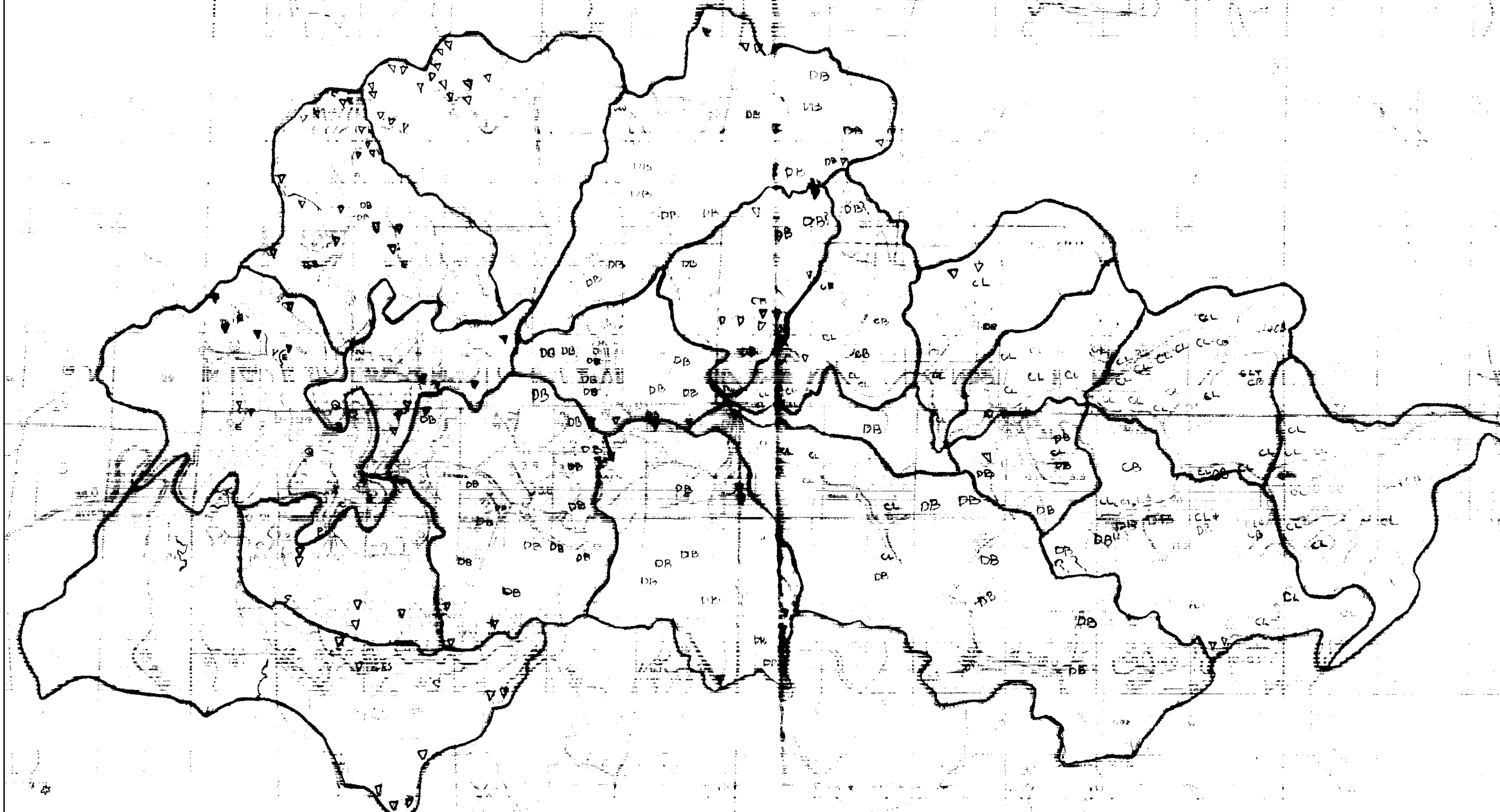
 partial cut operation

H = high density skid trails: greater than 150 ft average spacing in all directions

L = low density skid trails: less than 150 ft. average spacing in all directions.

G = slopes less than 35% dominate
S = slopes 35 to 60% dominate
M = G and S slopes both well represented
ignore C

Figure 20



Map of some important types of disturbances noted on the 8/1970 and 7/1994 aerial photos. The 6/1989 aerial photos were used to fill in the gaps in the 7/1994 coverage (not all of the 7/1994 are currently available).

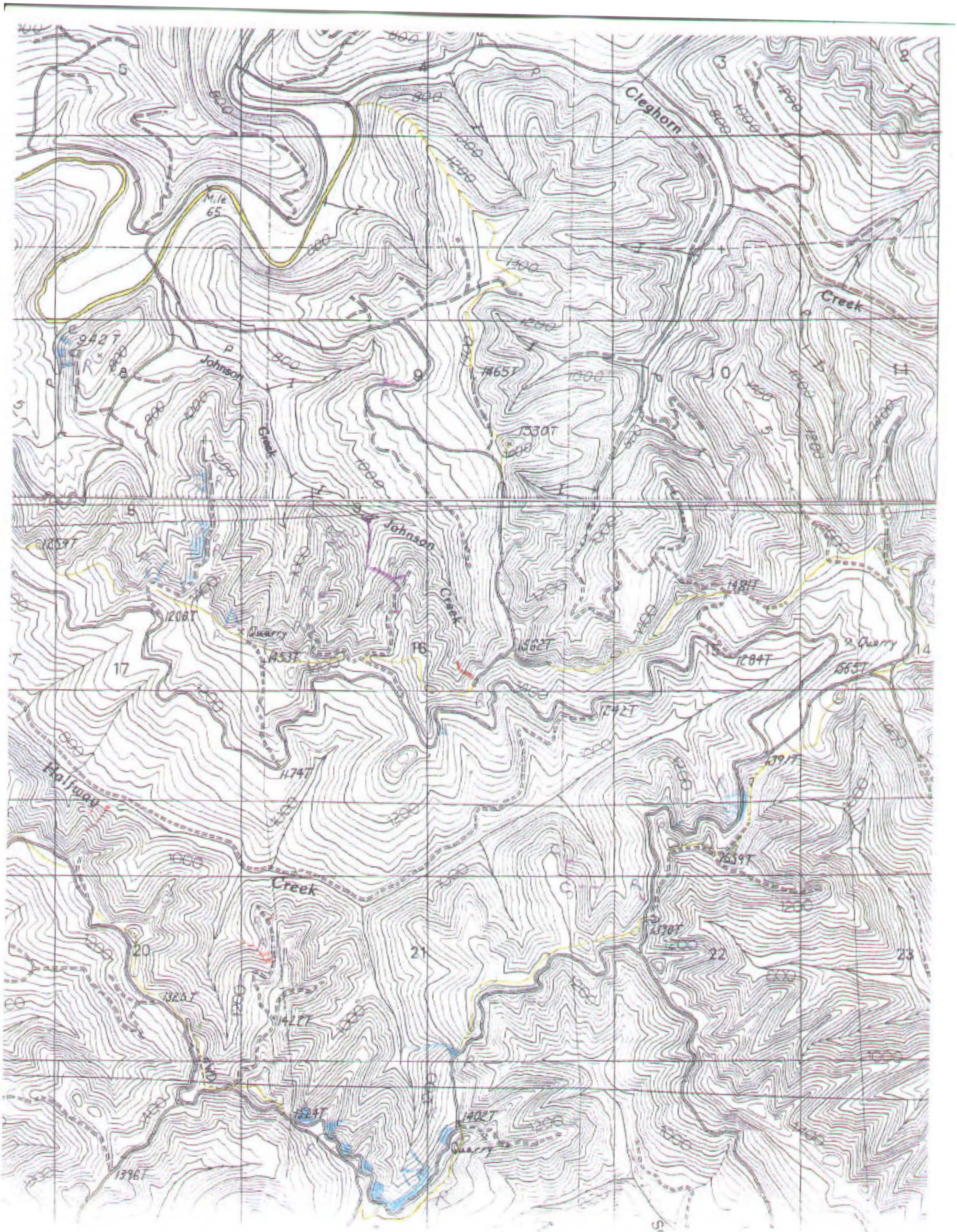
∇ = Landslides at least 0.1 acres in size

▼ = Landslides at least 0.1 acres in size which are still largely unvegetated and probably experiencing acellerated erosion

DB = Clearcut operations where roads were built at or near creek and river bottoms, where skid trails often extended from these roads up the bottom of side draws and where downhill logging operations were accomplished. These operations mostly took place primarily where steep terrain made conventional cat logging in a mat of skid trails impractical (DB for draw bottom).

CL = Cat logging (mapping was only done for Elk and Halfway Creeks eastward)


SMITH
RIVER
Halfway
Creek
West Fork Halfway Creek
R 8 W
R 7 W
4WD
Mile 58
Mile 60


Cleghorn
Creek
Mile 65
Johnson
Creek
Johnson
Creek
Halfway
Creek
Quarry
Quarry
Quarry
942T
1465T
1330T
1259T
1208T
1453T
1562T
1481T
1284T
1565T
1242T
1474T
1391T
1559T
1427T
1524T
1402T
1398T

Landslide Map of the Halfway Creek and Johnson Creek subbasins

- mid 1950's to 1959
- 1959 to 7/1964 (non identified
- 7/1964 to 8/1970
- 8/1970 to 5/1978
- 5/1978 to 5/1983
- 5/1983 to 6/1989
- 6/1989 to 7/1994 (non identified)

c = occurence in man-made clearances; not road related

R = attributable to the presence of a road (road related)

Example of creek and draw bottom operations along Cleghorn Creek and its tributaries in 1959. It is mixed with conventional cat operations

Figure 22. Periodicity chart showing adult migration timing of anadromous fish species in the Smith River drainage.

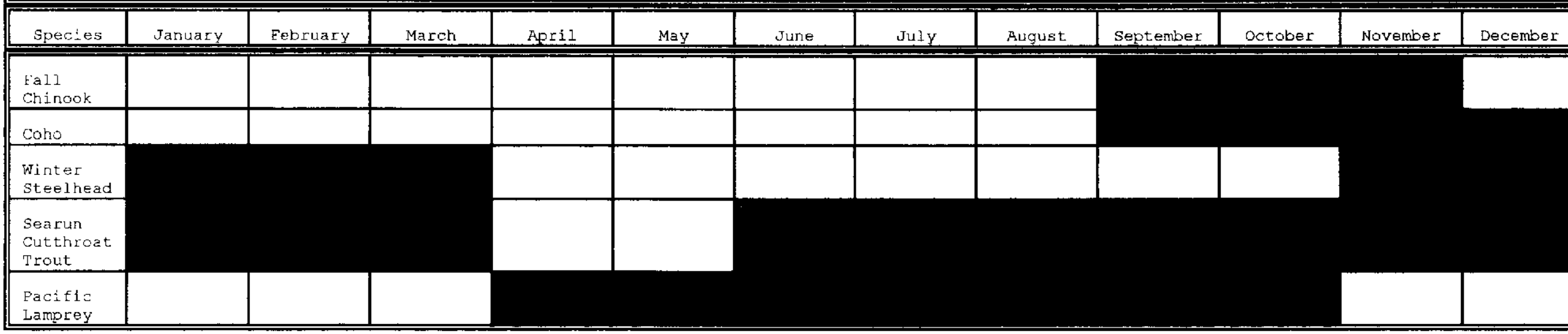
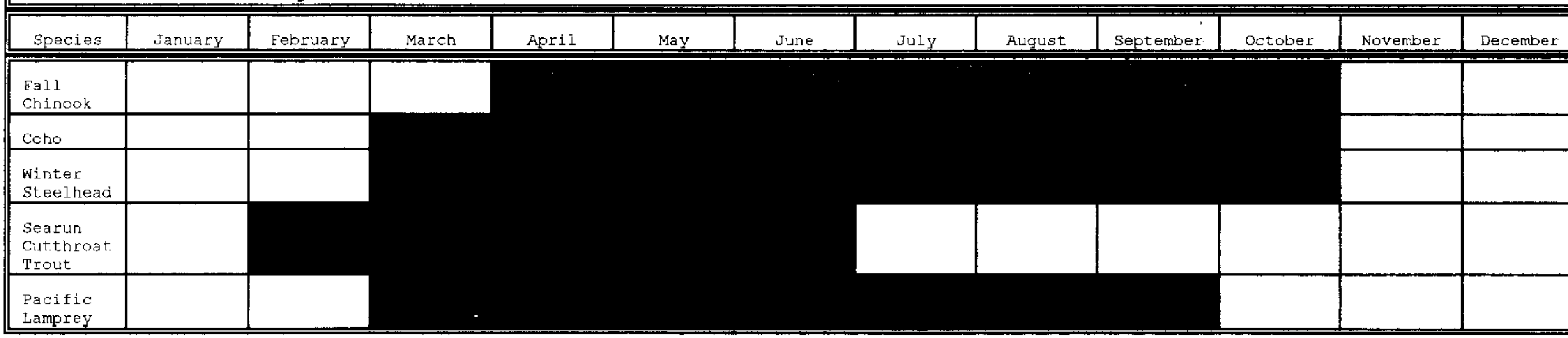
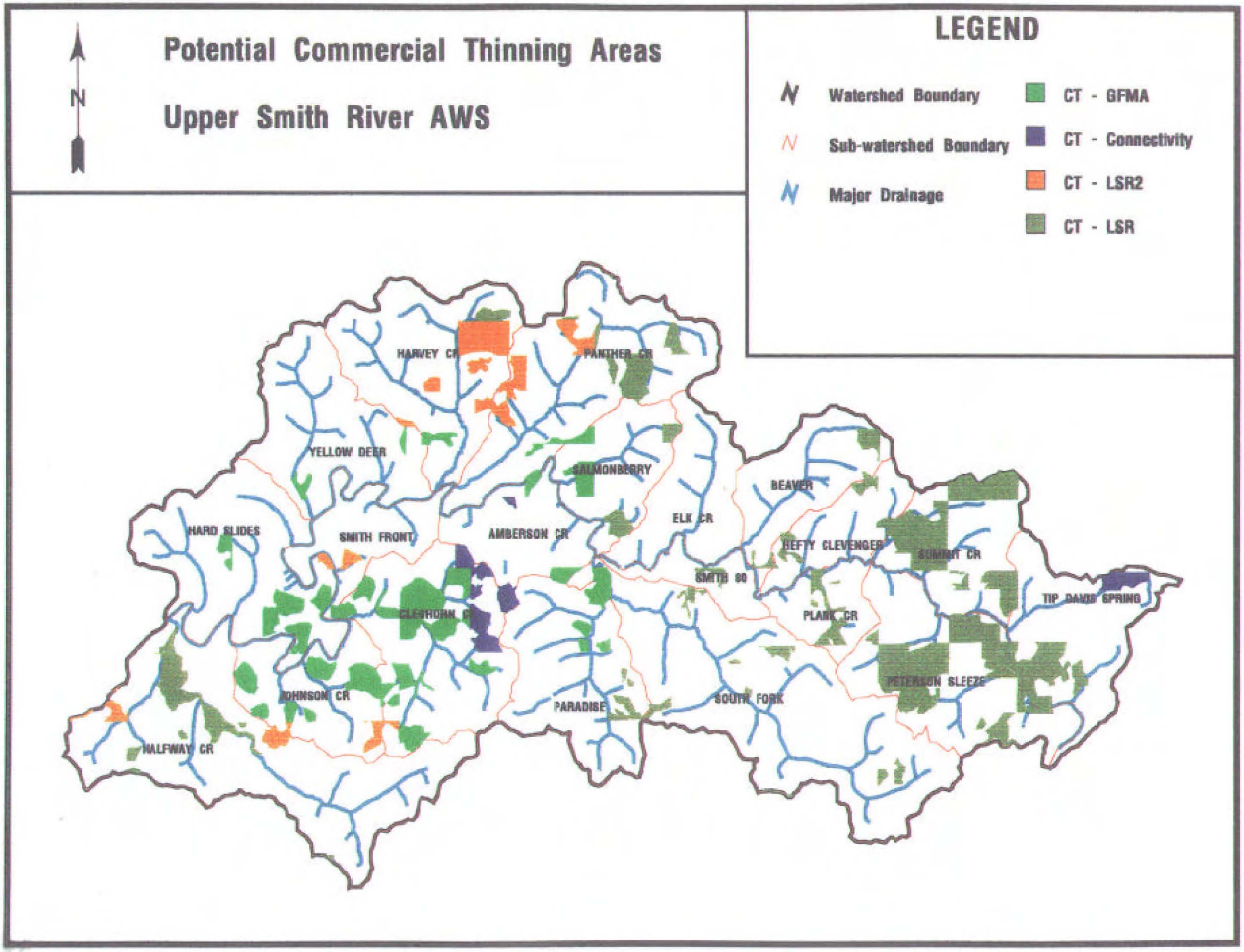
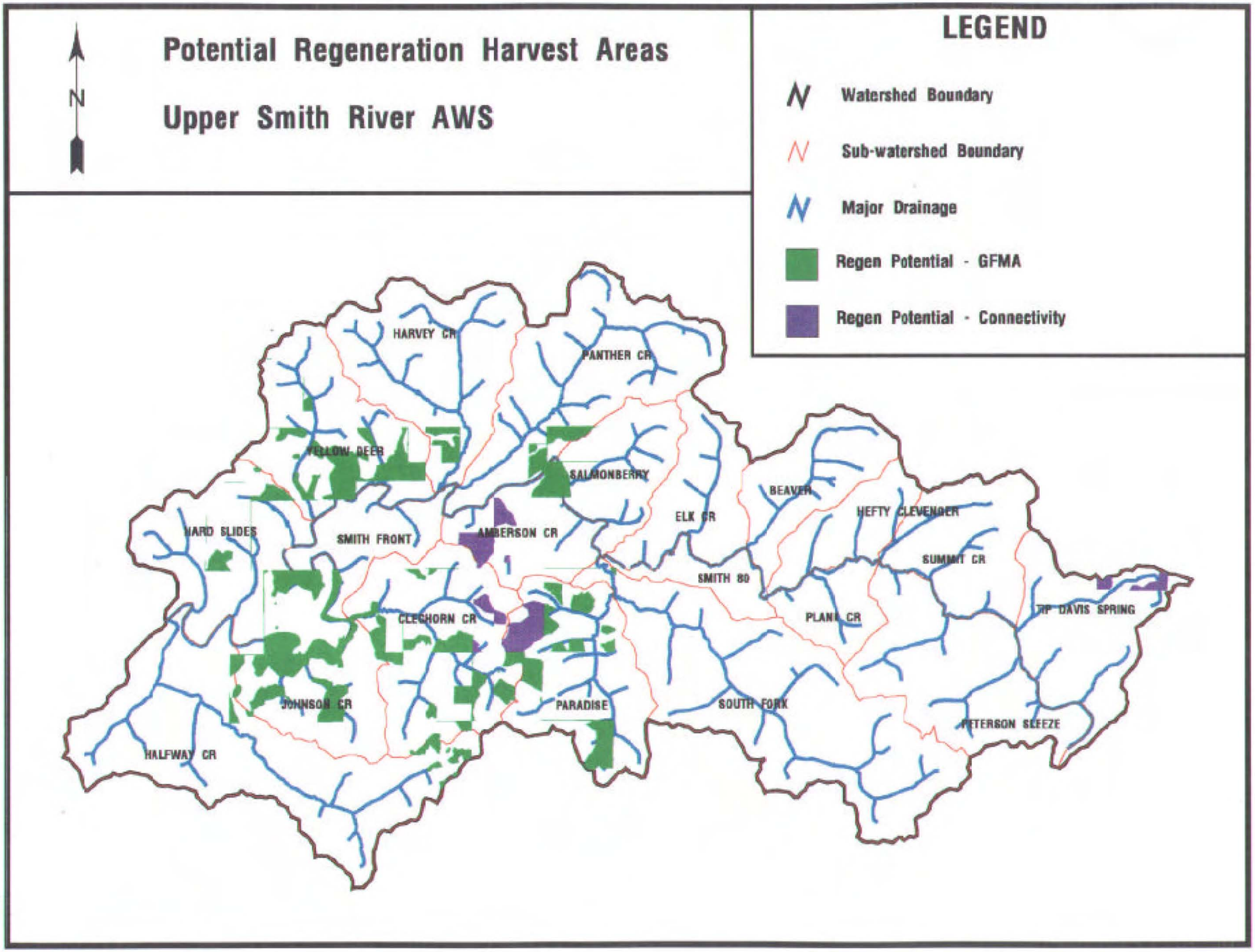


Figure 23. Periodicity chart showing juvenile outmigration timing of anadromous fish species in the Smith River drainage.



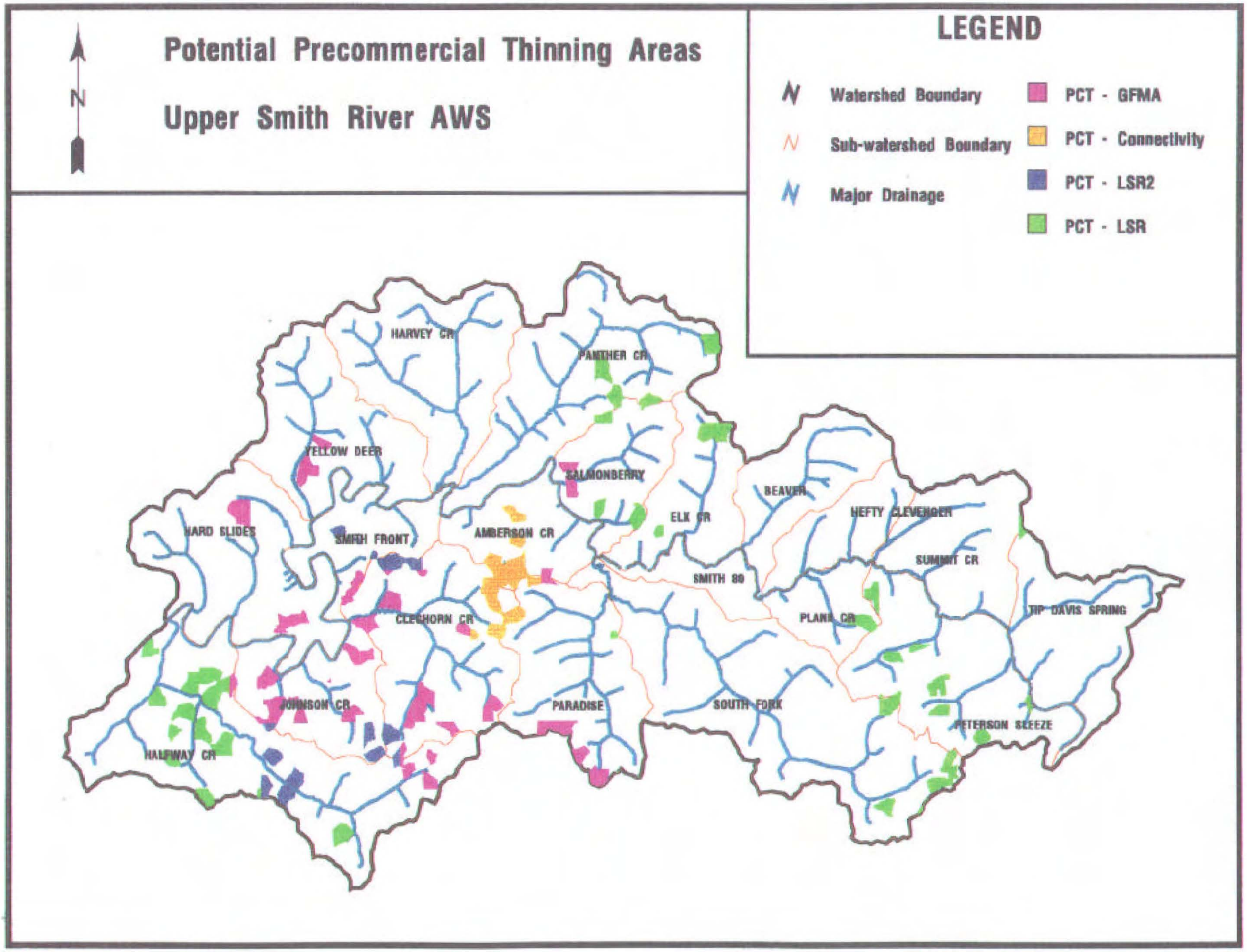

Potential Commercial Thinning Areas
Upper Smith River AWS
N
LEGEND
Watershed Boundary
Sub-watershed Boundary
Major Drainage
CT - GFMA
CT - Connectivity
CT - LSR2
CT - LSR
HARVEY CR
PANTHER CR
YELLOW DEER
SALMONBERRY
BEAVER
ELK CR
HARD SLIDES
SMITH FRONT
AMBERSON CR
HEFTY CLEVENGER
SMITH 80
PLANK CR
PARADISE
SOUTH FORK
JOHNSON CR
HALFWAY CR
SLEEZE

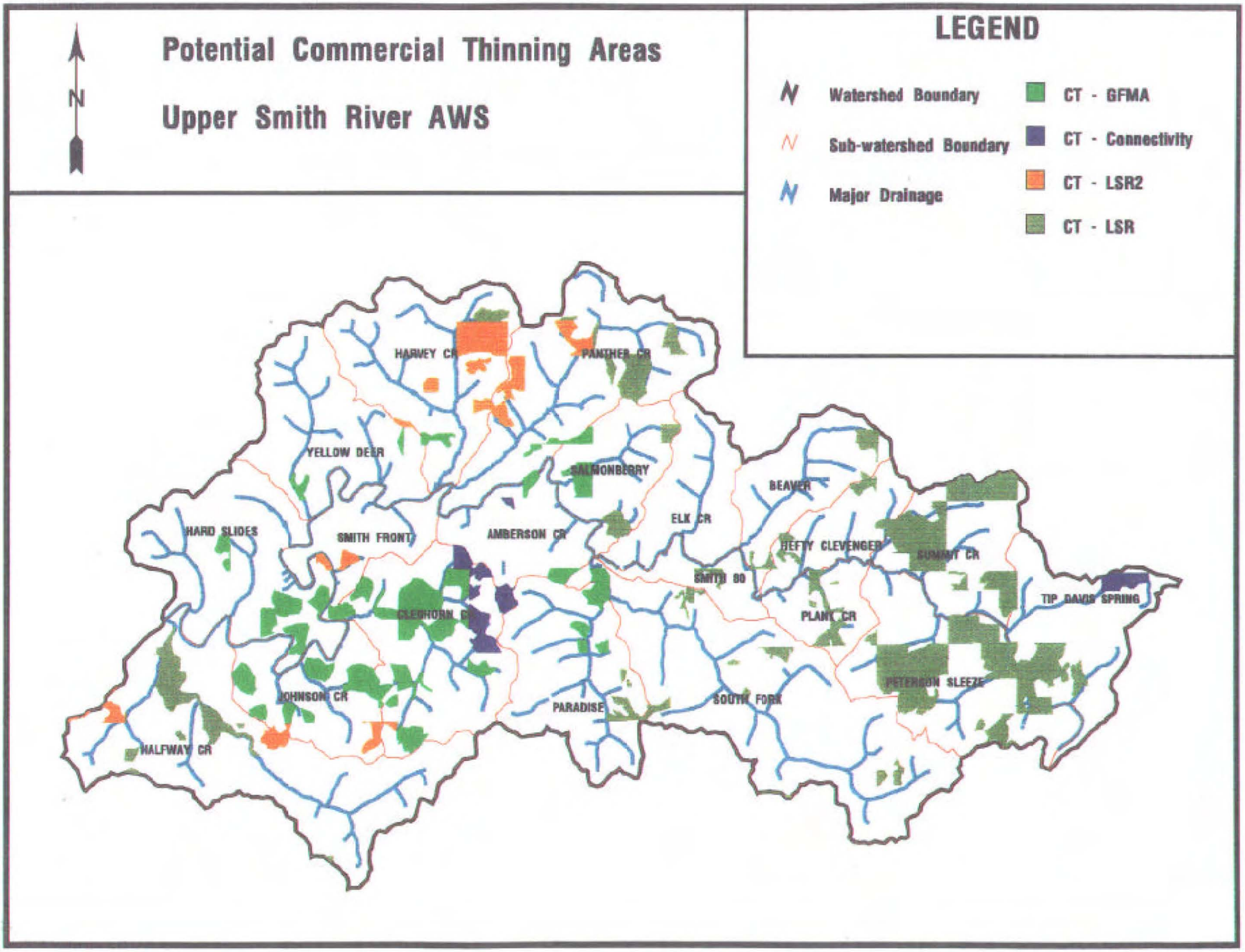


Potential Regeneration Harvest Areas
Upper Smith River AWS
N
LEGEND
Watershed Boundary
Sub-watershed Boundary
Major Drainage
Regen Potential - GFMA
Regen Potential - Connectivity
HARVEY CR
PANTHER CR
YELLOW DEER
SALMONBERRY
BEAVER
HEFTY CLEVENGER
ELK CR
HARD SLIDES
SMITH FRONT
AMBERSON CR
SUMMIT CR
SMITH 80
CLEGHORN CR
PLANT CR
DAVIS SPRING
JOHNSON CR
PARADISE
SOUTH FORK
PETERSON SLEEZE
HALFWAY CR

Potential Precommercial Thinning Areas

Upper Smith River AWS




Potential Commercial Thinning Areas
Upper Smith River AWS
N
LEGEND
Watershed Boundary
Sub-watershed Boundary
Major Drainage
CT - GFMA
CT - Connectivity
CT - LSR2
CT - LSR
HARVEY CR
PANTHER CR
YELLOW DEER
SALMONBERRY
BEAVER
ELK CR
HARD SLIDES
SMITH FRONT
AMBERSON CR
HEFTY CLEVENGER
SUMMIT CR
SMITH 80
TIP DAVIS SPRING
CLEGHORN CR
PLANT CR
PETERSON SLEEZE
JOHNSON CR
PARADISE
SOUTH FORK
HALFWAY CR

Potential Precommercial Thinning Areas

Upper Smith River AWS